Traffic Impact Analysis

WALMART RETAIL STORE

Harford County, Maryland

August 24, 2012

Prepared for:

Bowman Consulting Group, Ltd

Merging Innovation and Excellence®

The Traffic Group

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JJC/clg
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INTRODUCTION AND SUMMARY OF FINDINGS

Traffic Impact Analysis

WALMART RETAIL STORE
Harford County, Maryland

Prepared for
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STUDY PURPOSE

The Traffic Group, Inc. has prepared this Traffic Impact Analysis to determine the impact of the proposed development of a Walmart Retail Store on the surround area roadway system. Walmart is proposing an 189,564 sq. ft. Walmart Retail Store on approximately 17 acres of land within an approximately 34 acre site that is zoned for commercial uses. The subject site is located on the south side of Plumtree Road bounded by MD 24 to the west and MD 924 to the east

As typically requested by the Maryland State Highway Administration (SHA) and Harford County Government, general assumptions need to be made to the potential buildout of the remainder of the site for purposes of this Traffic Impact Analysis. To be conservative with this analysis, high trip generating uses were used for the approximate 17 acres of developable land.

Access to the property is proposed via one point along Plumtree Road, one point along MD 924, and a connection to Blue Spruce Drive. Blue Spruce Drive is proposed to be extended northerly to Plumtree Road from Bel Air South Parkway. At this time, no access is proposed to MD 24, since MD 24 is a controlled access highway. It is anticipated that access would not be granted by SHA if requested.

STUDY CRITERIA/METHODOLOGY

The Scope of Work for this Traffic Impact Study was prepared and approved by both Harford County and SHA in a meeting dated April 17, 2012. The Scope of Work can be found in Appendix A.

Harford County's Adequate Public Facilities Ordinance (APFO) requires the use of Highway Capacity Manual (HCM) Analysis for all study intersections. The Maryland State Highway Administration (SHA) requires the use of Critical Lane Volume (CLV) Analysis to quantify levels of service at state maintained intersections.

SCOPE OF SERVICES

The principal scope of services undertaken as part of this study was as follows.

- *Conduct field inspection to collect physical information concerning the nearby road system.*
- *Collect intersection turning movement counts during the morning and evening peak hours, and on Saturday afternoon while schools are in session.*
- *Provide an appropriate growth factor to the traffic counts.*
- *Obtain information from Harford County regarding approved but un-built background developments.*
- *Develop trip generation and trip distribution for all background developments and the subject development.*
- *Prepare an evaluation of the road network using CLV, HCM, and SYNCHRO criteria.*
- *Prepare queuing analyses using SimTraffic and the SHA's 95th Percentile Methodology.*
- *Provide an overall assessment of traffic conditions based on information contained in this report.*

Summary of Findings and Recommendations

After a detailed review of the data and analysis contained within this report, the following road improvements would assist with operations throughout the region and would mitigate the Walmart Retail Store plus the additional proposed development on the subject site:

MD 24 at Plumtree Road

The HCM Analysis for this intersection projects Level of Service "E" conditions during the evening peak period under both background and total traffic conditions and acceptable Levels of Service throughout the other peak periods. CLV Analyses also indicates that during the evening peak hour under background and total conditions, Level of Service "F" conditions are projected and Level of Service "E" conditions are projected during the Saturday midday peak hour under total traffic conditions.

Suggested improvements at this intersection include adding a second southbound MD 24 left turn lane and a second westbound Plumtree Road left turn lane. These physical improvements along with changing the side street movements to a split phase mitigate the site's impact at this location.

MD 24 at Bel Air South Parkway

The HCM Analysis for this intersection projects Level of Service "E" conditions during the evening peak period under both background and total traffic conditions and acceptable Levels of Service throughout the other peak periods. SHA CLV Analyses also indicates that during the evening peak hour under background and total conditions, Level of Service "F" conditions are projected (under existing conditions, Level of Service "E" conditions are experienced) and Level of Service "E" conditions are projected during the Saturday midday peak hour under total traffic conditions.

To mitigate the site's impact, a second left turn lane is recommended along both eastbound and westbound Bel Air South Parkway onto MD 24.

Bel Air South Parkway at Blue Spruce Drive

Recently, Harford County had a Capital Improvement Program (CIP) project for the intersection of Bel Air South Parkway and Blue Spruce Road. The project was a fully funded single lane roundabout. Prior to the County Council finalizing the 2012 budget, funding was removed for this project. Because of the subject site's impact to this intersection, improvements are required. With the implementation of a traffic signal, minor street delay is reduced and an acceptable level of service can be provided. This improvement would mitigate the site's impacts.

MD 924 at Bel Air South Parkway

Currently, this intersection exhibits Level of Service "E" and "F" conditions during the evening and Saturday peak periods using both the HCM and SHA CLV Methodologies. In order to improve conditions, the following improvements are recommended:

- Provide an additional through lane in the northbound direction. It is anticipated that the northbound lane will continue north of the new site access and drop at Plumtree Road; and
- Provide a second eastbound left turn lane from Bel Air South Parkway onto northbound MD 924 while changing the right most lane to a shared through/right turn lane.

The implementation of these improvements mitigates the site's traffic impacts.

MD 924 at Bright Oaks Drive/Site Access

Traffic signalization is recommended to facilitate access to and egress from the site. In addition, a second through lane will be needed along northbound MD 924 within this road segment. A separate left turn lane is recommended along northbound 924.

A separate right turn lane is needed along southbound MD 924. The site access approach should provide a shared left through lane and separate right turn lane.

Based on providing the improvements listed above, the Walmart Retail Store and the potential buildout of the remaining acreage of the site as depicted in this report should satisfy Harford County Guidelines.

The data and methodology used to undertake this study is detailed in the sections that follow.

EXISTING TRAFFIC CONDITIONS

SITE INFORMATION

The proposed development includes an 189,564 sq. ft. Walmart Retail Store on approximately 17 acres of land within an approximately 34 acre site that is zoned for commercial uses. The subject site is located on the south side of Plumtree Road bounded by MD 24 to the west and MD 924 to the east.

Access to the property is proposed via one point along Plumtree Road, one point along MD 924, and a connection to Blue Spruce Drive. Blue Spruce Drive is proposed to be extended northerly to Plumtree Road from Bel Air South Parkway. Exhibit 1 details the Site Location Map which shows the relative area of the subject site and all study intersections while Exhibit 1A details the Conceptual Site Plan.

STUDY AREA

Based on the Traffic Impact Study Scoping Agreement with Harford County, the following intersections were included in this analysis:

1. Business US 1 @ MD 24;
2. MD 924 @ MacPhail Road;
3. MD 24 @ Ring Factory Road;
4. MD 924 @ Ring Factory Road;
5. MD 924 @ Patterson Mill Road/Barrington Place;
6. Plumtree Road @ Tollgate Road;
7. MD 24 @ Plumtree Road;
8. MD 924 @ Plumtree Road;
9. Bel Air South Parkway @ Tollgate Road;
10. MD 24 @ Bel Air South Parkway;
11. Bel Air South Parkway @ Blue Spruce Drive;
12. MD 924 @ Bel Air South Parkway;
13. Wheel Road @ Tollgate Road;
14. MD 24 @ Wheel Road;
15. MD 924 @ Wheel Road;
16. Wheel Road @ Laurel Bush Road;
17. MD 24 @ Singer Road;
18. MD 924 @ Singer Road;
19. Plumtree Road @ Site Access; and
20. MD 924 @ Bright Oaks Drive/Site Access.

Exhibit 2 has been prepared to summarize the existing lane use and traffic control devices at each of the study intersections. In addition, aerial photography and traffic signal plans can be found in Appendix A.

TRAFFIC VOLUMES

Turning Movement Counts were collected at each of the key intersections from 7 to 9 AM and 4 to 6 PM on a weekday and from 11 AM to 2 PM on a Saturday. The peak hour turning movement counts are summarized in Exhibit 3 and the complete turning movement count worksheets can be found in Appendix A.

All weekday data was collected in May 2012 while Harford County Schools were in session. The Saturday counts were also collected in May 2012 on a non-holiday weekend to reflect typical conditions.

ANALYSIS OF EXISTING TRAFFIC CONDITIONS

Intersection Capacity Analyses were undertaken using the SHA Critical Lane Volume (CLV) Methodology and the Highway Capacity Manual (HCM) Methodology for each of the key intersections. The results are summarized in Exhibits 12 (CLV) and 13 (HCM) while the worksheets can be found in Appendix B. Of the 20 intersections analyzed under existing conditions during the morning, evening, and Saturday Peak Periods, the following were found to have unacceptable LOS:

SHA CLV Methodology (Time Period)

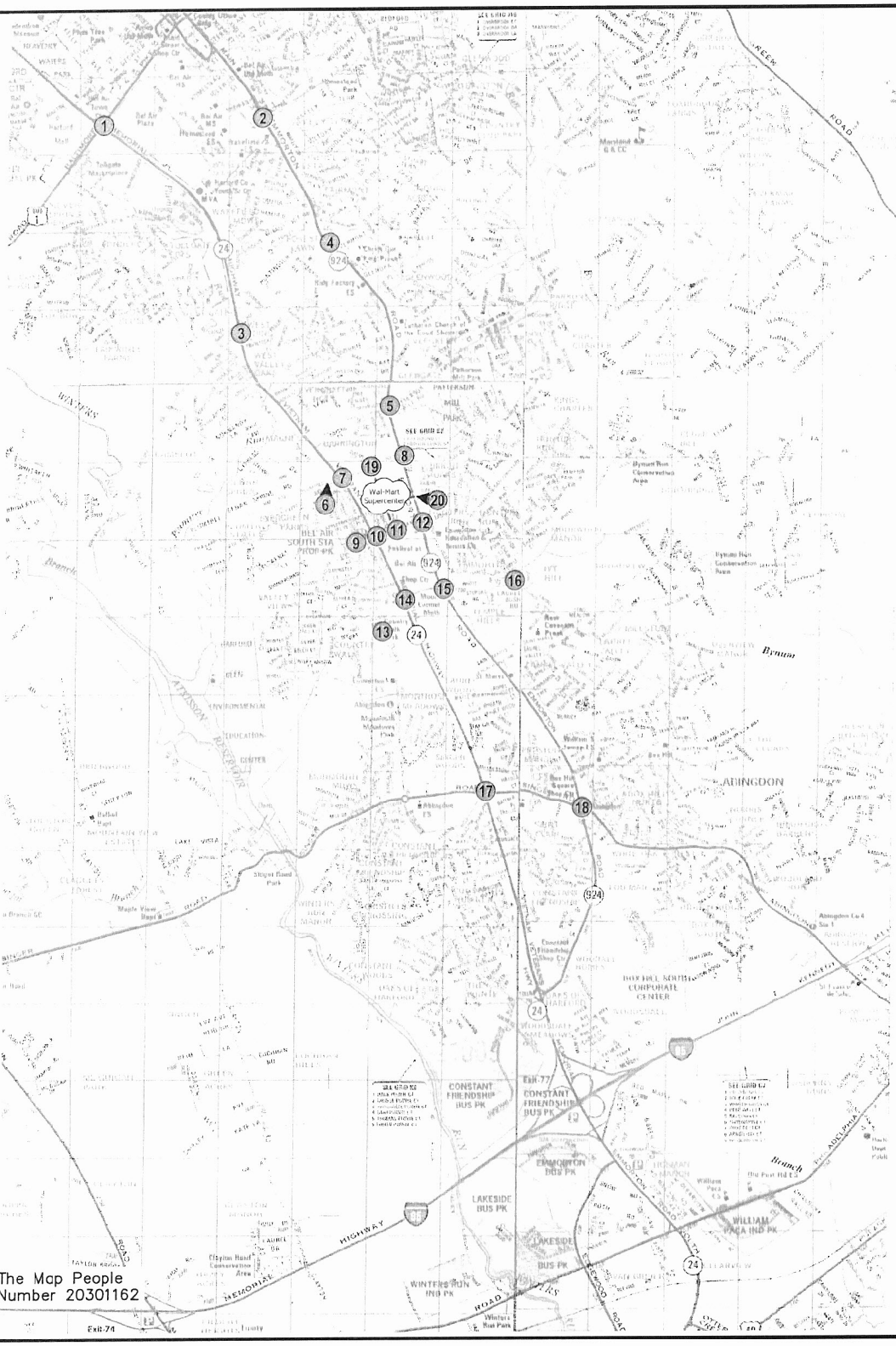
- MD 24 @ Bel Air South Parkway (PM);
- MD 24 @ Wheel Road (PM);
- MD 24 @ Singer Road (PM);

HCM Methodology (Time Period)

- MD 24 @ Ring Factory Road (AM);
- Bel Air South Parkway @ Blue Spruce Drive (PM, Sat.);
- MD 924 @ Bel Air South Parkway (PM);
- MD 24 @ Singer Road (PM);

An HCM Arterial Analysis was also requested for MD 924 between Wheel Road and Patterson Mill Road in both the northbound and southbound directions. The results can be found on Exhibit 14 while the worksheets can be found in Appendix B. The results show that the average arterial speeds in this section of roadway range from 16 mph to 28 mph.

Queuing analyses were also conducted using both SimTraffic and the SHA 95th Percentile Methodologies. The results can be found on Exhibits 15 (SimTraffic) and 15A (SHA).



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Study Intersection

EXHIBIT 1
SITE LOCATION MAP

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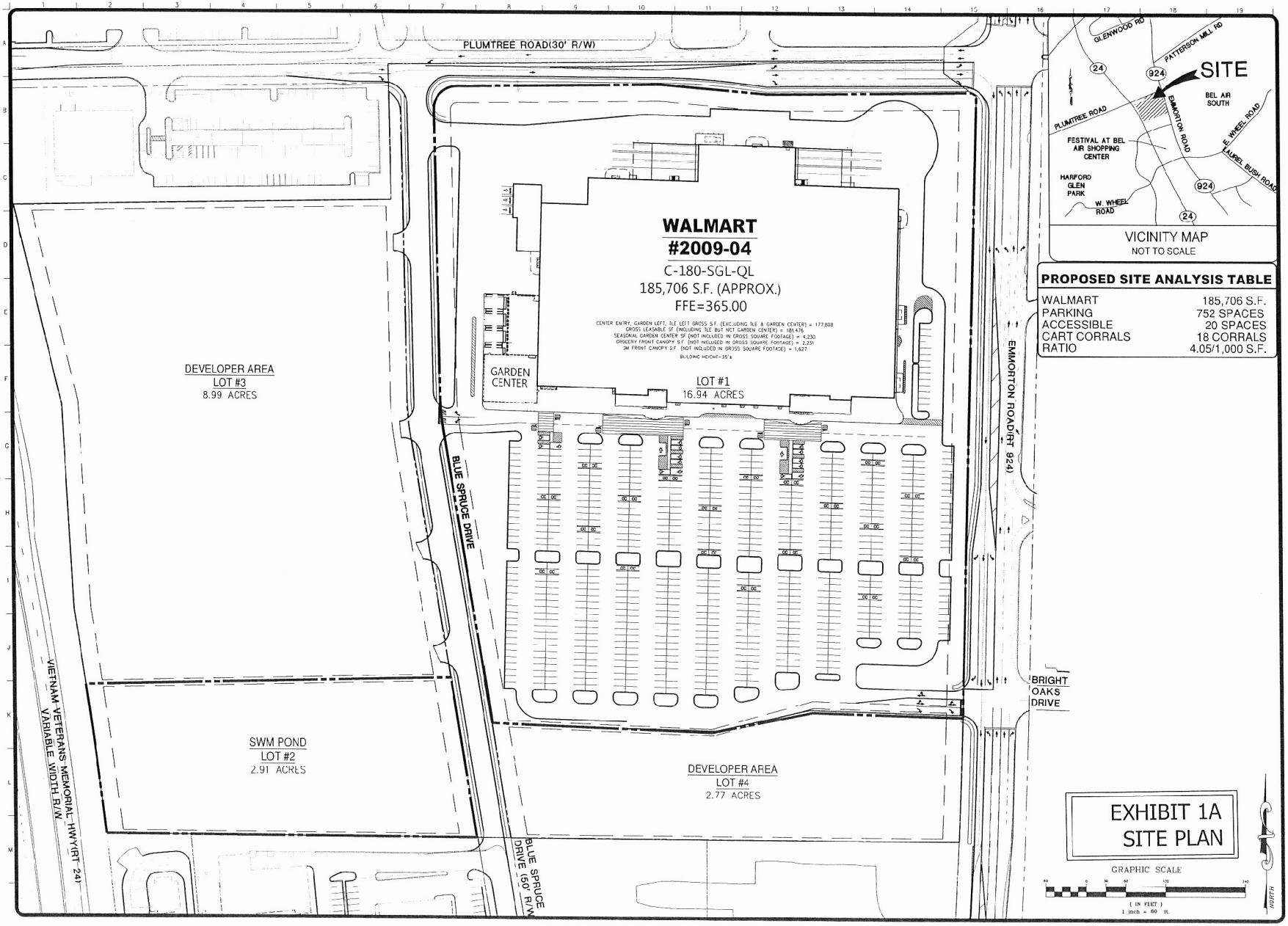

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WALMART #2009-04
ABINGDON, HARFORD COUNTY, MARYLAND
WAL-MART STORES, INC.
2001 SE 10TH STREET
BENTONVILLE, AR 72716

Walmart

DESIGN DRAWN
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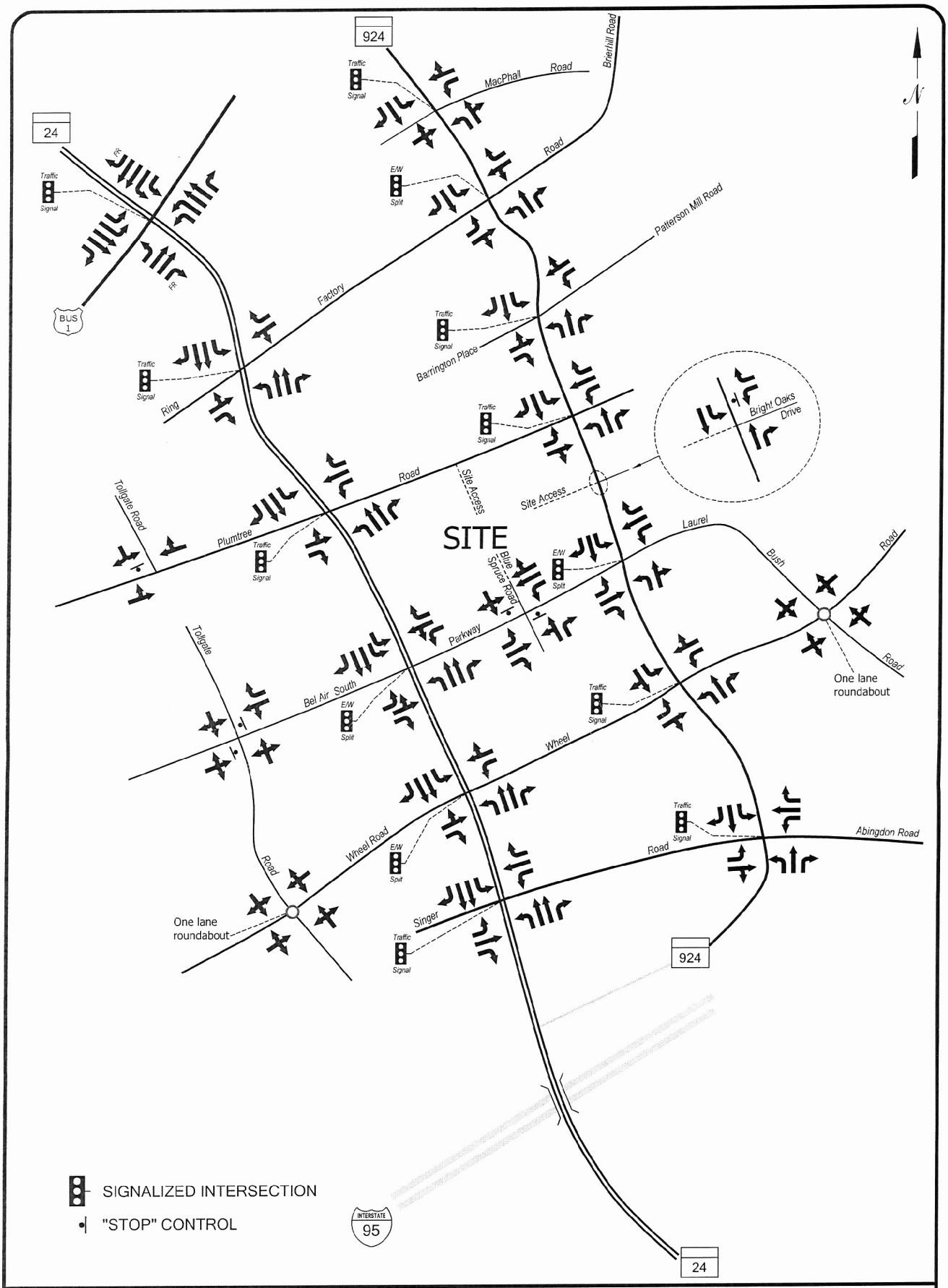
1
OF 1 SHEETS


924
24
BUS 1
Traffic Signal
E/W Split
MacPhail Road
Briarhill Road
Road
Patterson Mill Road
Factory
Barrington Place
Ring
Bright Oaks Drive
Site Access
Site Access
SITE
Tollgate Road
Plumtree Road
Blue Spruce Road
Laurel Bush Road
Parkway
Tollgate Road
Bel Air South Parkway
Wheel Road
Wheel Road
Abingdon Road
Singer Road
One lane roundabout
One lane roundabout
INTERSTATE 95
SIGNALIZED INTERSECTION
"STOP" CONTROL
NOT TO SCALE
EXHIBIT 2
EXISTING LANE USE
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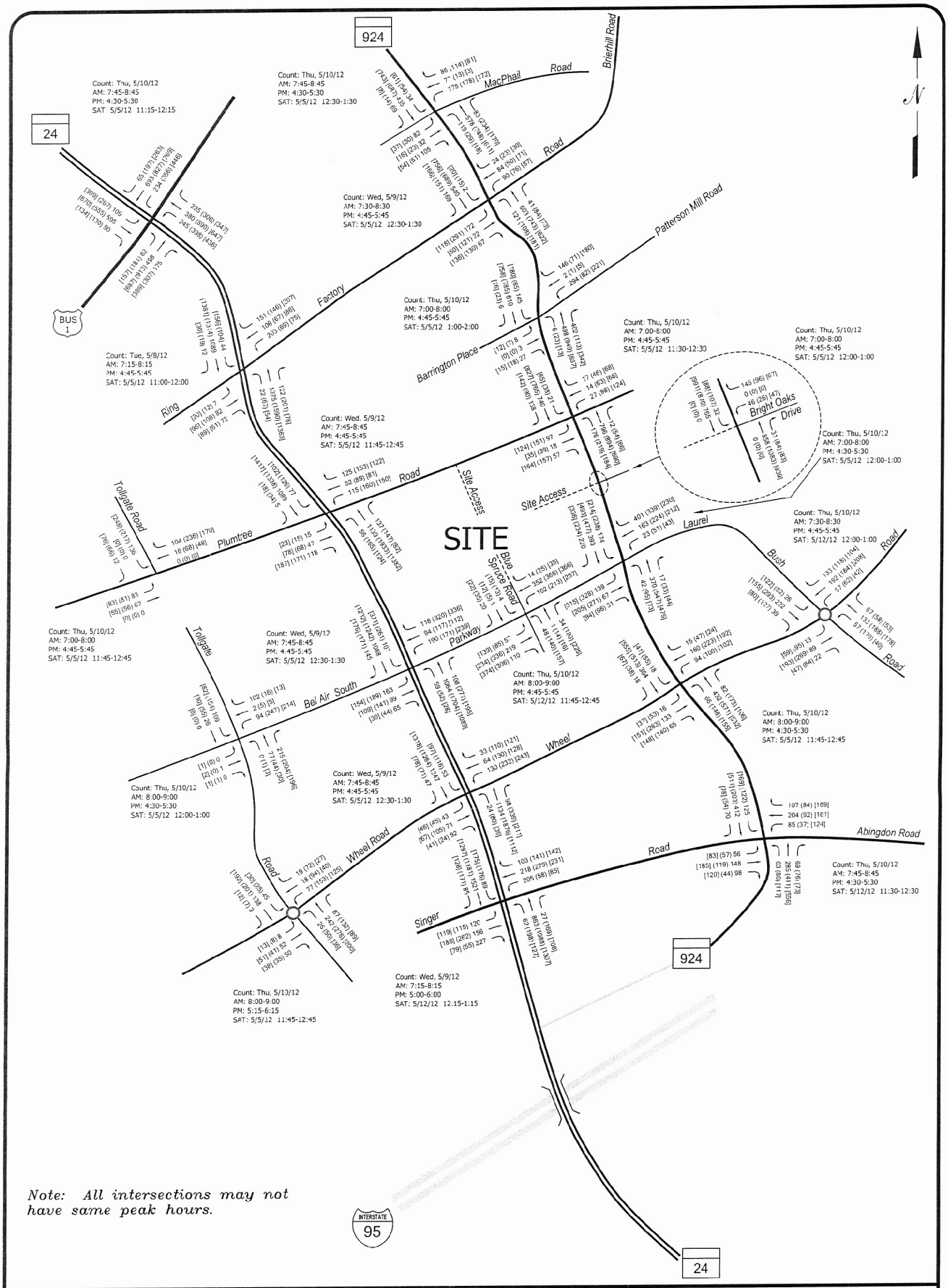

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(00) - EVENING PEAK HOUR
[00] - SATURDAY MIDDAY PEAK HOUR

EXHIBIT 3
EXISTING PEAK HOUR TRAFFIC VOLUMES

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BACKGROUND TRAFFIC CONDITIONS

DESIGN YEAR(S)

It is anticipated that this new development will be constructed within 3 years (2015). Harford County requires a 2.2% annual increase in traffic for 3 years. The resulting regional growth is shown on Exhibit 4 while Exhibit 5 details the 2015 Base Peak Hour Traffic Volumes which combines the existing traffic volumes and regional traffic growth.

BACKGROUND TRAFFIC

Information was obtained from Harford County regarding approved background developments in the vicinity of the subject site. Exhibit 6 details Trip Generation Rates and Totals for the 21 approved background developments in the vicinity of the subject site. The trip totals are based on data contained in the Institute of Transportation Engineers (ITE) Trip Generation 8th Edition.

Exhibit 7 details the combined trips generated on the surrounding area roadway network, while each individual developments trip distribution can be found in Appendix C. Exhibit 8 details the 2015 Background Peak Hour Traffic Volumes which combines the combined trips generated by the 21 approved background developments and the 2015 Base Peak Hour Traffic Volumes.

ANALYSIS OF BACKGROUND TRAFFIC CONDITIONS

Intersection Capacity Analyses were undertaken using the SHA Critical Lane Volume (CLV) Methodology and the Highway Capacity Manual (HCM) Methodology for each of the key intersections based on the 2015 Background Peak Hour Traffic Volumes. The results are summarized in Exhibits 12 (CLV) and 13 (HCM) while the worksheets can be found in Appendix B.

Of the 20 intersections analyzed during the morning, evening, and Saturday Peak Periods, the following were found to have projected unacceptable LOS even with the absence of the development on the proposed site:

SHA CLV Methodology (Time Period)

- Business US 1 @ MD 24 (PM);
- MD 924 @ MacPhail Road (PM);
- MD 924 @ Ring Factory Road (Sat.);
- MD 24 @ Plumtree Road (PM);
- MD 924 @ Plumtree Road (Sat.);

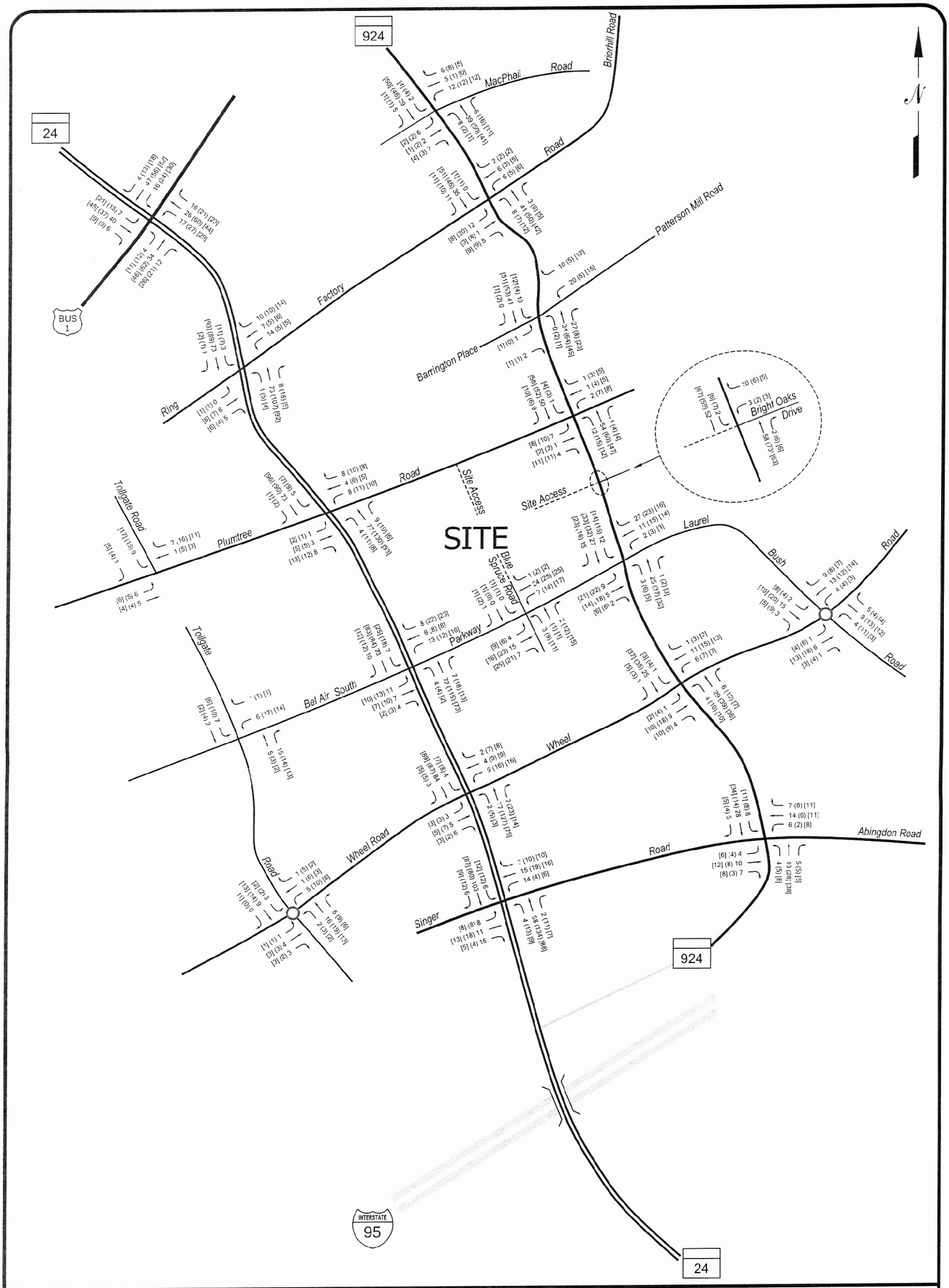
- MD 24 @ Bel Air South Parkway (PM);
- MD 924 @ Bel Air South Parkway (PM, Sat.);
- MD 24 @ Wheel Road (PM); and
- MD 24 @ Singer Road (AM, PM, Sat.).

HCM Methodology (Time Period)

- MD 24 @ Ring Factory Road (AM, Sat.);
- MD 924 @ Ring Factory Road (Sat.);
- MD 924 @ Patterson Mill Road/Barrington Place (Sat.);
- MD 24 @ Plumtree Road (PM);
- MD 24 @ Bel Air South Parkway (PM);
- Bel Air South Parkway @ Blue Spruce Drive (PM, Sat.);
- MD 924 @ Bel Air South Parkway (PM, Sat.);
- MD 24 @ Wheel Road (PM);
- MD 24 @ Singer Road (PM);
- MD 924 @ Singer Road (Sat.); and
- MD 924 @ Bright Oaks Drive (PM, Sat.).

An HCM Arterial Analysis was also requested for MD 924 between Wheel Road and Patterson Mill Road in both the northbound and southbound directions. The results can be found on Exhibit 14 while the worksheets can be found in Appendix B. The results show that the projected average arterial speeds in this section of roadway range from 12 mph to 27 mph.

Queuing analyses were also conducted using both SimTraffic and the SHA 95th Percentile Methodologies. The results can be found on Exhibits 15 (SimTraffic) and 15A (SHA).



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[00] - SATURDAY MIDDAY PEAK HOUR

EXHIBIT 4
REGIONAL TRAFFIC GROWTH (2.2% ANNUAL RATE FOR 3 YEAR TO 2015)

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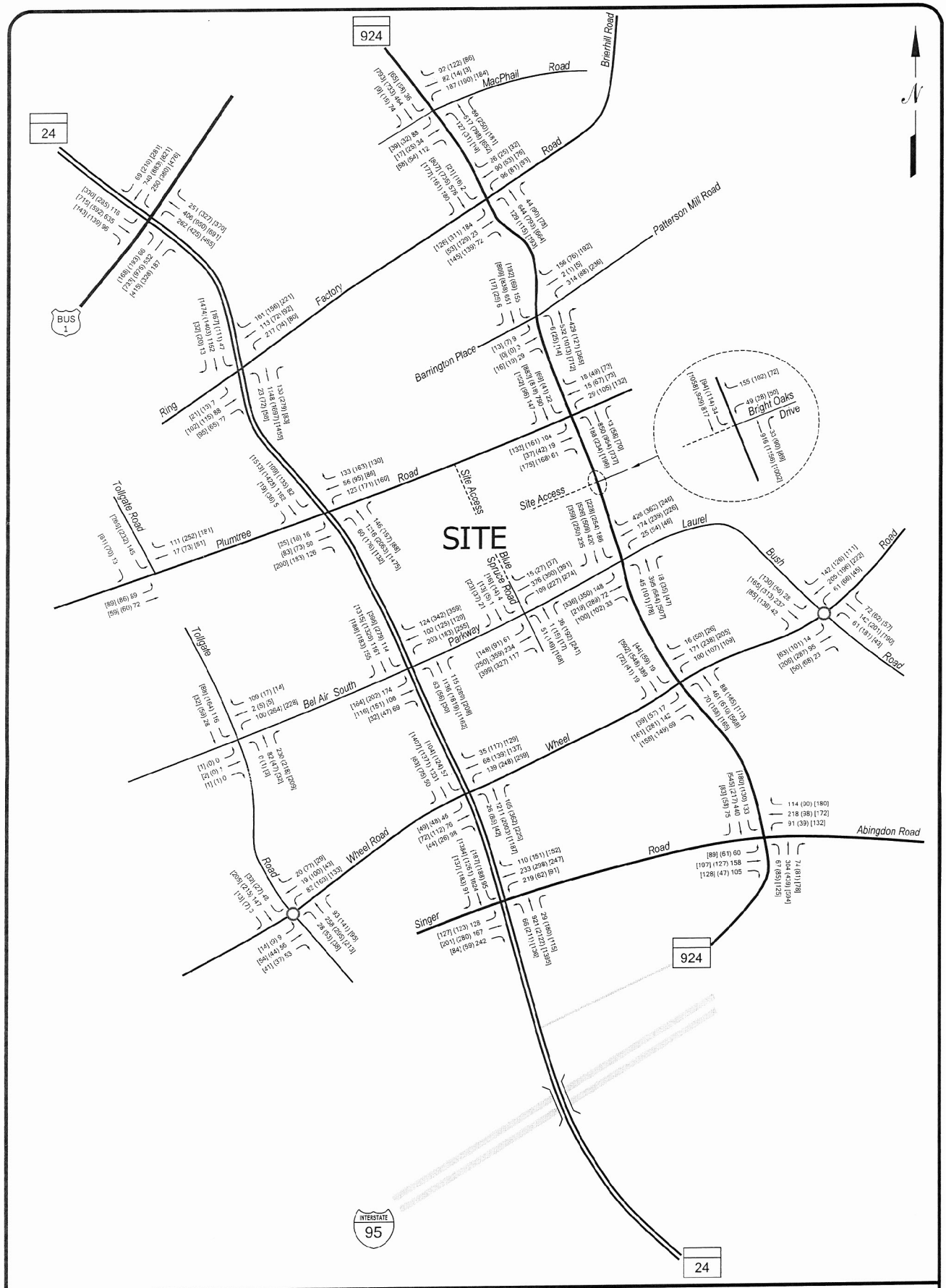

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EXHIBIT 5
2015 BASE PEAK HOUR TRAFFIC VOLUMES

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TRIP GENERATION RATES

LAND USE / FORMULA	DISTRIBUTION
Single-Family Detached (ITE-210, Units)	
Morning Trips = 0.70 x (Units) + 9.74, for 15 or less units, reverse PM trips	25/75
Ln(Evening Trips) = 0.90 x Ln(Units) + 0.51	63/37
Midday Sat. Trips = 0.89 x Units + 9.56 (for more than 10 units)	53/47
Midday Sat. Trips = 0.93 (for 10 or less units)	53/47
Townhouse Units (ITE-230, Units)	
Ln(Morning Trips) = 0.80 x Ln(Units) + 0.26	17/83
Ln(Evening Trips) = 0.82 x Ln(Units) + 0.32	67/33
Midday Sat. Trips = 0.47 x Units	54/46
Apartment Units (ITE-220, Units)	
Morning Trips = 0.49 x Units + 3.73	20/80
Evening Trips = 0.55 x Units + 17.65	65/35
Midday Sat. Trips = 0.41 x Units + 19.23	50/50
General Office (ksf, ITE-710)	
Ln(Morning Trips) = 0.80 x Ln(ksf) + 1.55	88/12
Evening Trips = 1.12 x (ksf) + 78.81, for 50k or less units, reverse AM trips	17/83
Midday Sat. Trips = 0.81 x ksf - 0.12	54/46
Senior Adult Housing Attached (ITE-252, Units)	
Morning Trips = 0.13 x Units	36/64
Evening Trips = 0.16 x Units	60/40
Midday Sat. Trips = 0.30 x Units	50/50
Mini-Warehouse (ksf, ITE-151)	
Morning Trips = 0.15 x ksf	59/41
Evening Trips = 0.26 x ksf	51/49
Midday Sat. Trips = 0.40 x ksf	64/36

Note: Trip generation rates derived from ITE Trip Generation, 8th Edition, 2008.

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EXHIBIT 6
TRIP GENERATION RATES AND TOTALS
FOR BACKGROUND DEVELOPMENT

TRIP GENERATION TOTALS

	MORNING PEAK HOUR			EVENING PEAK HOUR			SAT. MIDDAY PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL
1. 3105 Abingdon Road									
4 Single-Family Detached Units	2	4	6	4	2	6	2	2	4
2. 3109 Abingdon Road									
4 Single-Family Detached Units	2	4	6	4	2	6	2	2	4
3. Abingdon Addition									
22 Single-Family Detached Units	6	19	25	17	10	27	15	14	29
4. Greenbrier Hills									
142 Senior Adult Housing Attached units	6	12	18	14	9	23	21	22	43
5. Bentley									
7 Senior Adult Housing Attached units	0	1	1	1	0	1	1	1	2
6. Evergreen Farms									
198 Apartment Units	20	81	101	83	44	127	50	50	100
7. Lands of Ross									
12 Single-Family Detached Units	6	10	16	10	6	16	11	9	20
8. MacPhail Woods									
1 Single-Family Detached Units	1	1	2	1	1	2	1	0	1
74 Condo Units	7	34	41	31	16	47	35	29	64
9. Medley Estates									
33 Single-Family Detached Units	8	25	33	25	14	39	21	18	39
10. Melissa Manor									
9 Single-Family Detached Units	4	8	12	8	4	12	4	4	8
11. Monmouth Meadows (Phase V)									
75 Townhouse Units	7	34	41	31	16	47	19	16	35
24 Condo Units	3	13	16	13	6	19	27	23	50
12. Richardson's Legacy (Unbuilt units)									
15 Single-Family Detached Units	5	15	20	12	7	19	12	11	23

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EXHIBIT 6 CONT'D
TRIP GENERATION RATES AND TOTALS
FOR BACKGROUND DEVELOPMENT

TRIP GENERATION TOTALS

	MORNING PEAK HOUR			EVENING PEAK HOUR			SAT. MIDDAY PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL
13. Van Bibber									
9 Single-Family Detached Units	4	8	12	8	4	12	4	4	8
14. Your Space at Bel Air									
111,110 sq.ft. Mini-Warehouse	10	7	17	15	14	29	29	15	44
15. Boulevard at Box Hill (Lot 5)									
85,775 sq.ft. Retail	52	34	86	281	293	574	404	372	776
Pass-by Trips (41%, 37%)	0	0	0	-115	-120	-235	-149	-138	-287
New Trips	***52***	***34***	***86***	***166***	***173***	***339***	***255***	***234***	***489***
16. Boulevard at Box Hill (Lot 21)									
25,400 sq.ft. Retail	15	10	25	124	130	254	183	169	352
Pass-by Trips (58%, 38%)	0	0	0	-72	-75	-147	-70	-64	-134
New Trips	***15***	***10***	***25***	***52***	***55***	***107***	***113***	***105***	***218***
17. Box Hill Corporate Center (Lots 8 and 9)									
76,605 sq.ft. General Office	134	18	152	28	137	165	16	14	30
18. Magness Exemption									
127 Single-Family Detached Units	25	74	99	82	48	130	65	58	123
175 Townhouse Units	14	67	81	64	31	95	44	38	82
19. 1129 Clayton Road									
3,000 sq.ft. General Office	10	1	11	1	10	11	1	1	2
20. Patterson Mill Fire Substation									
8,825 sq.ft. fire Substation	24	3	27	3	24	27	3	2	5
21. Global Healthcare Systems, Inc.									
Convert an existing 4,420 sq. ft. commercial building to a doctor's office						No new trips			

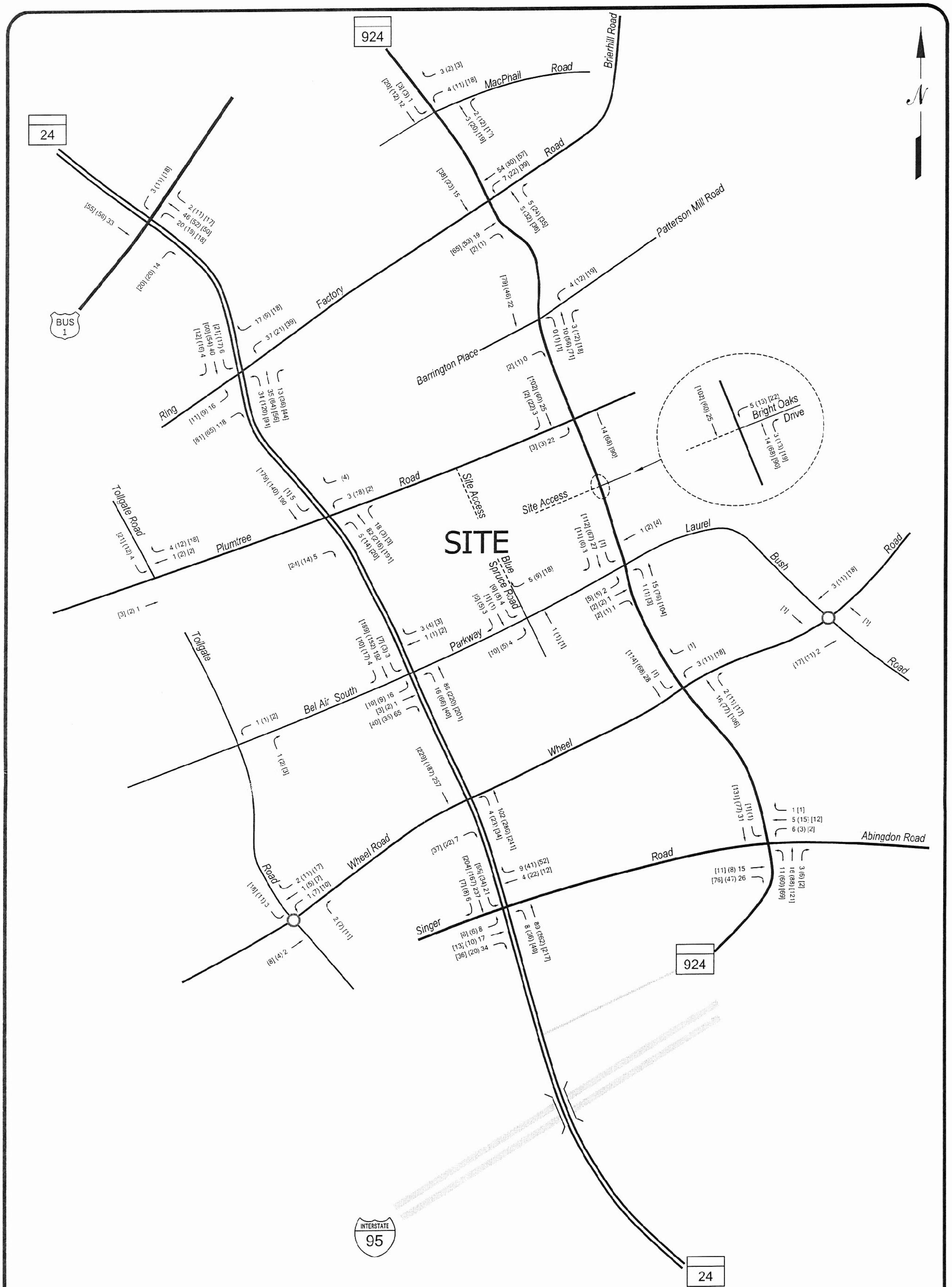

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EXHIBIT 7
TRIPS GENERATED BY BACKGROUND DEVELOPMENTS

18

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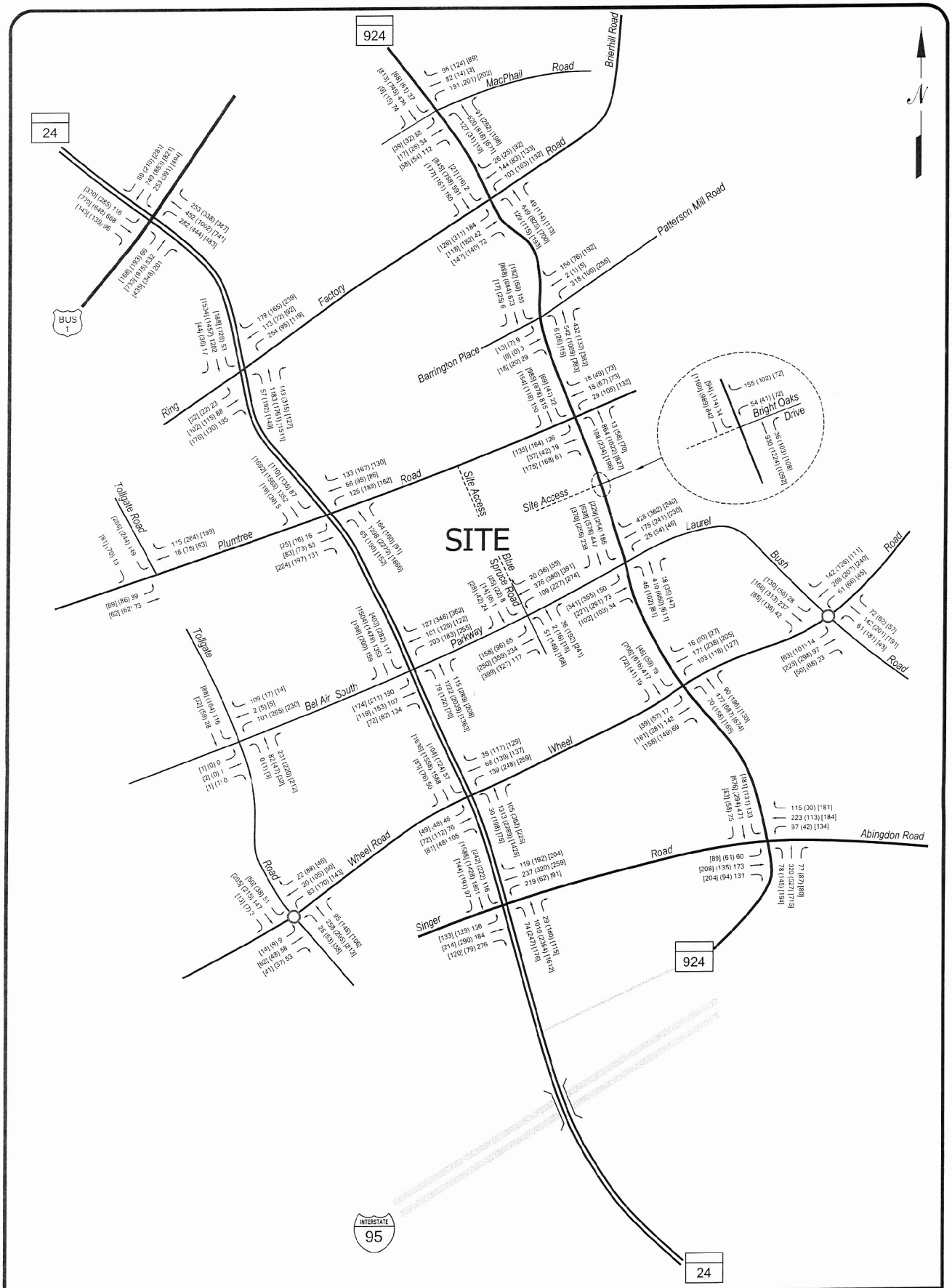

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(00) - EVENING PEAK HOUR
[00] - SATURDAY MIDDAY PEAK HOUR

EXHIBIT 8
2015 BACKGROUND PEAK HOUR TRAFFIC VOLUMES

TOTAL TRAFFIC CONDITIONS

SITE INFORMATION

The proposed development includes an 189,564 sq. ft. Walmart Retail Store on approximately 17 acres of land within an approximate 34 acre site that is zoned for commercial uses. The subject site is located on the south side of Plumtree Road bounded by MD 24 to the west and MD 924 to the east.

For purposes of this Traffic Impact Analysis, conservative assumptions were made to the potential buildout of the remaining approximately 17 acres of the site. Although no uses have been confirmed for the remainder of the property, we utilized traffic counts for potential uses that would be permitted in this zoning classification, in order to develop a conservative assessment of the traffic. The potential uses analyzed for the remainder of the site include: a 4,880 sq. ft. convenience market with gas pumps, two (2) 8,000 sq. ft. high turnover sit down restaurants, two (2) 8,000 sq. ft. quality restaurants, and 4,500 sq. ft. of additional retail.

Access to the property is proposed via one point along Plumtree Road, one point along MD 924, and a connection to Blue Spruce Drive. Blue Spruce Drive is proposed to be extended northerly to Plumtree Road from Bel Air South Parkway. Exhibit 1 details the Site Location Map which shows the relative area of the subject site and all study intersections while Exhibit 1A details the Conceptual Site Plan.

TRIP GENERATION/DISTRIBUTION

Exhibit 9 details the Trip Generation Rates and Trip Generation Totals based on data contained in the Institute of Transportation Engineers (ITE) Trip Generation 8th Edition for each individual land use within the proposed site. Pass-by trips were deducted as allowed by ITE's Trip Generation Handbook 2nd Edition. Additionally, Harford County allowed a 5% trip reduction for multi-purpose on-site trips; however, we believe that percentage should be higher based on information previously provided to Harford County and substantiated by ITE. In addition, no credit is taken for the trips associated with the existing Walmart located in Abingdon, just south of this proposed Walmart which will be closed once the new Walmart is constructed. It is anticipated that some of the trips on the roadway network today, would be rerouted to the new Walmart but again, is not shown in this analysis. Therefore, it is our opinion that the projected trip generation for this site is conservative and overestimated.

Please note the net new trips from Walmart are 54% in the morning peak hour, 71% in the evening peak hour, and 73% in the Saturday Peak Hour of all the projected net new trips to the entire site.

The generated trips for this development have been distributed throughout the roadway network. The following exhibits detail the trip distribution:

- Exhibit 10A - Trip Distribution for Walmart and Retail;
- Exhibit 10B - Trip Distribution for Gas Station;
- Exhibit 10C - Trip Distribution for Restaurants; and
- Exhibit 10D - Pass-by Trip Assignment.

Exhibit 10E details the combination of all the trip distribution and pass-by trips for this development. Exhibit 11 details the 2015 Total Peak Hour Traffic Volumes which adds the trips projected to be generated by this development to the background peak hour traffic volumes.

ANALYSIS OF TOTAL TRAFFIC CONDITIONS

Intersection Capacity Analyses were undertaken using the SHA Critical Lane Volume (CLV) Methodology and the Highway Capacity Manual (HCM) Methodology for each of the key intersections based on the 2015 Total Peak Hour Traffic Volumes. The results are summarized in Exhibits 12 (CLV) and 13 (HCM) while the worksheets can be found in Appendix B.

An HCM Arterial Analysis was also requested for MD 924 between Wheel Road and Patterson Mill Road in both the northbound and southbound directions. The results can be found on Exhibit 14 while the worksheets can be found in Appendix B. The results show that the projected average arterial speeds in this section of roadway range from 11 mph to 27 mph. With the improvements suggested above, the majority of the projected average arterial speeds are increased.

Queuing analyses were also conducted using both SimTraffic and the SHA 95th Percentile Methodologies. The results can be found on Exhibits 15 (SimTraffic) and 15A (SHA).

Of the 20 intersections analyzed during the morning, evening, and Saturday Peak Periods, the following were found to have projected unacceptable LOS:

Please note that all but one (1) of the intersections is projected to exhibit unacceptable levels of service with or without the proposed development.

SHA CLV Methodology (Time Period - Bold is additional time period from Background)

- Business US 1 @ MD 24 (PM);
- MD 924 @ MacPhail Road (PM);
- MD 924 @ Ring Factory Road (Sat.);
- MD 24 @ Plumtree Road (PM, **Sat.**);
- MD 924 @ Plumtree Road (**PM**, Sat.);
- MD 24 @ Bel Air South Parkway (PM, **Sat.**);
- MD 924 @ Bel Air South Parkway (PM, Sat.);
- MD 24 @ Wheel Road (PM); and

- MD 24 @ Singer Road (AM, PM, Sat.); and
- MD 924 @ Singer Road (Sat.);

HCM Methodology (Time Period – Bold is additional time period from Background)

- MD 24 @ Ring Factory Road (AM, Sat.);
- MD 924 @ Ring Factory Road (Sat.);
- MD 924 @ Patterson Mill Road/Barrington Place (Sat.);
- MD 24 @ Plumtree Road (PM);
- Bel Air South Parkway @ Tollgate Road (**PM**);
- MD 24 @ Bel Air South Parkway (PM);
- Bel Air South Parkway @ Blue Spruce Drive (**AM**, PM, Sat.);
- MD 924 @ Bel Air South Parkway (PM, Sat.);
- MD 24 @ Wheel Road (PM);
- MD 24 @ Singer Road (PM);
- MD 924 @ Singer Road (Sat.); and
- MD 924 @ Bright Oaks Drive/Site Access (**AM**, PM, Sat.).

Below, please find discussion of the intersections and potential mitigation.

Additionally, please note that mitigation is based on the entire development of the site even though this application is based on the Walmart Retail Store only.

Business US 1 at MD 24

Based on Harford County Guidelines, this intersection is deemed acceptable and no improvements are required at this location.

Under SHA Guidelines using the CLV Methodology, this intersection is projected to exhibit Level of Service "E" conditions under the background condition during the evening peak period. The subject site impact is minimal and level of service will remain at Level of Service "E" with full buildout. The proposed Walmart Retail Store adds 63 trips and the entire proposed development adds 64 trips during the evening peak hour out of a projected 5,920 trips which is 1.06% and 1.08% of the total, respectively or 1 more car per minute added to the intersection.

Since this intersection passes Harford County Guidelines and the site is projected to generate minimal trips to this intersection, improvements are not required.

MD 924 at MacPhail Road

Based on Harford County Guidelines, this intersection is deemed acceptable and no improvements are required at this location.

Under SHA Guidelines using the CLV Methodology, this intersection is projected to exhibit Level of Service "E" conditions under the background condition during the evening peak period. The subject site impact is minimal and level of service will remain at Level of Service "E" with full buildout. The proposed Walmart Retail Store adds 59 trips and the entire proposed development adds 68 trips during the evening

peak hour out of a projected 2,450 trips which is 2.4% and 2.8% of the total, respectively or about 1 more car per minute added to the intersection.

Since this intersection passes Harford County Guidelines and is projected to generate minimal trips to this intersection, improvements are not required. For information purposes, one improvement that would mitigate the site's impacts is to construct an eastbound MacPhail Road right turn lane, however, right-of-way would likely limit the feasibility of this improvement.

MD 24 at Ring Factory Road

During the morning and Saturday midday peak period using the HCM Methodology, this intersection is projected to exhibit unacceptable Level of Service conditions under the background condition. With the subject site impact, the level of service will remain unacceptable under both Methodologies.

It is our understanding based on field observations that modifications to this intersection are under construction to include a side street split phase of Ring Factory Road. With this improvement, this intersection is projected to exhibit acceptable levels of service during all time periods.

MD 924 @ Ring Factory Road

During the Saturday midday peak period using the CLV and HCM Methodologies, this intersection is projected to exhibit Level of Service "E" conditions under the background condition. With the subject site impact, the level of service will remain unacceptable under both Methodologies. However, under the weekday morning and evening peak hours, Level of Service "D" conditions or better are projected during all traffic conditions. The proposed Walmart Retail Store adds 160 trips and the entire proposed development adds 173 trips during the Saturday midday peak hour out of a projected 2,904 trips which is 5.5% and 5.95% of the total, respectively or about 3 more cars per minute added to the intersection.

Based on satisfying the weekday peak hours, it is suggested that improvements are not necessary since only Saturday's are slightly impacted (less than 6%) by this development.

For information purposes, one improvement that would mitigate the site's impacts is to construct a westbound Ring Factory Road left turn lane. This improvement would require the removal of the existing monumental entrance on the east side of Ring Factory Road.

MD 924 at Patterson Mill Road/Barrington Place

During the Saturday midday peak period using the HCM Methodology, this intersection is projected to exhibit Level of Service "E" conditions under the background condition. With the subject site impact, the level of service will remain unacceptable. However, under the weekday morning and evening peak hours, Level of Service "D" conditions or

better are projected during all traffic conditions. The proposed Walmart Retail Store adds 199 trips and the entire proposed development adds 242 trips during the Saturday midday peak hour out of a projected 3,003 trips which is 6.6% and 8.1% of the total, respectively or about 4 more cars per minute added to the intersection.

Based on satisfying the weekday peak hour level of service requirements, it is suggested that improvements are not necessary since only Saturday's are slightly impacted by this development.

It is our opinion that this intersection has adequate turn lanes in all directions and any improvements to a Saturday Peak Hour would require an additional through lane in either the north or south direction. Again, since the weekday peak hours are acceptable, we suggest that no improvements should be required at his location.

MD 24 at Plumtree Road

The HCM Analysis for this intersection projects Level of Service "E" conditions during the evening peak period under both background and total traffic conditions and acceptable Levels of Service throughout the other peak periods. CLV Analyses also indicates that during the evening peak hour under background and total conditions, Level of Service "F" conditions are projected and Level of Service "E" conditions are projected during the Saturday midday peak hour under total traffic conditions.

Suggested improvements at this intersection include adding a second southbound MD 24 left turn lane and a second westbound Plumtree Road left turn lane. These physical improvements along with changing the side street movements to a split phase mitigate the site's impact at this location.

MD 924 at Plumtree Road

Based on Harford County Guidelines, this intersection is deemed acceptable and no improvements are required at this location.

SHA CLV Analyses indicates that during the evening (total conditions) and Saturday midday peak (background and total conditions), Level of Service "E" conditions are projected.

Since this intersection is in close proximity to the site access, it is suggested to add a 3rd lane along eastbound Plumtree Road so the final configuration is one left turn lane, one through lane, and one right turn lane and add a second MD 924 northbound left turn lane. The implementation of these improvements mitigates the site's impact at this location, but again is not required per Harford County Guidelines.

Bel Air South Parkway at Tollgate Road

The HCM Two-Way Stop Analysis for this intersection projects a delay of 38 seconds per stopped vehicle (Bel Air South Parkway) during the evening peak period, which is Level of Service "E". Under background conditions, this delay is 31 seconds per

stopped vehicle. During the morning and Saturday midday peak periods, the stop delay is 13.3 and 17.8 seconds per vehicle for these movements. Please note that all other movements along Tollgate Road experience little to no delay when traveling through this intersection.

Under this analysis, acceptable level of service for the stopped vehicles is 35 seconds of delay or less (3 second difference). One way to mitigate these 3 seconds is to modify the intersection from a two-way stop to an all-way stop, which results in an average delay of 13 seconds per vehicle. This mitigation would reduce the delay for the stopped vehicles on Bel Air South Parkway, but would increase the delay for the stopped vehicles on Tollgate Road, which do not have to stop today.

Based on the minimal failure (3 seconds), minimal results achieved, and the increased delay to vehicles that do not have to stop today, we would suggest no improvement to the intersection at this time.

MD 24 at Bel Air South Parkway

The HCM Analysis for this intersection projects Level of Service "E" conditions during the evening peak period under both background and total traffic conditions and acceptable Levels of Service throughout the other peak periods. SHA CLV Analyses also indicates that during the evening peak hour under background and total conditions, Level of Service "F" conditions are projected (under existing conditions, Level of Service "E" conditions are experienced) and Level of Service "E" conditions are projected during the Saturday midday peak hour under total traffic conditions.

To mitigate the site's impact, a second left turn lane is recommended along both eastbound and westbound Bel Air South Parkway onto MD 24.

Bel Air South Parkway at Blue Spruce Drive

Recently, Harford County had a Capital Improvement Program (CIP) project for the intersection of Bel Air South Parkway and Blue Spruce Road. The project was a fully funded single lane roundabout. Prior to the County Council finalizing the 2012 budget, funding was removed for this project. Because of the subject site's impact to this intersection, improvements are required. With the implementation of a traffic signal, minor street delay is reduced and an acceptable level of service can be provided. This improvement would mitigate the site's impacts.

MD 924 at Bel Air South Parkway

Currently, this intersection exhibits Level of Service "E" and "F" conditions during the evening and Saturday peak periods using both the HCM and SHA CLV Methodologies. In order to improve conditions, the following improvements are recommended:

- Provide an additional through lane in the northbound direction. It is anticipated that the northbound lane will continue north of the new site access and drop at Plumtree Road; and

- Provide a second eastbound left turn lane from Bel Air South Parkway onto northbound MD 924 while changing the right most lane to a shared through/right turn lane.

The implementation of these improvements mitigates the site's traffic impacts.

MD 24 at Wheel Road

With or without the development of the subject site, this intersection is projected to exhibit Level of Service "E" conditions during the evening peak period under both HCM and CLV Methodologies. MD 24 currently features two through lanes in each direction in addition to separate left turn and right turn lanes. In order to improve levels of service, additional lanes are recommended on the minor approaches. It is important to recognize significant grading would be required in order to provide this improvement.

The proposed Walmart Retail Store adds 155 trips and the entire proposed development adds 212 trips during the evening peak hour out of a projected 5,441 trips which is 2.8% and 3.9% of the total, respectively or about 3 to 4 more cars per minute added to the intersection.

At this time, it is suggested that no improvements be recommended at this location. For informational purposes, the implementation of one additional lane along each minor approach mitigates the site's impacts.

MD 924 at Wheel Road

Based on Harford County Guidelines, this intersection is deemed acceptable and no improvements are required at this location.

SHA CLV Analyses also projects Level of Service "D" conditions or better throughout all of the peak periods.

The proposed Walmart Retail Store adds 92 trips and the entire proposed development adds 107 trips during the evening peak hour out of a projected 2,757 trips which is 3.3% and 3.9% of the total, respectively or about 2 more cars per minute added to the intersection. At this time, it is suggested that no improvements be required at this location.

MD 24 at Singer Road

The HCM Analysis for this intersection projects unacceptable level of service conditions during the evening peak period under existing, background, and total traffic conditions and acceptable Levels of Service throughout the other peak periods.

SHA CLV Analyses also indicates that during the evening peak hour under existing, background and total conditions, Level of Service "F" conditions are projected. Also, Level of Service "E" conditions are projected during the morning and Saturday midday peak hour under background and total traffic conditions.

The proposed Walmart Retail Store adds 60, 122, and 159 trips and the entire proposed development adds 117, 172, and 224 trips during the morning, evening, and Saturday midday peak hour out of a projected 4,475, 5,896, and 5,112 trips which is 1.3%, 2.0%, and 3.1% (Walmart Retail Store) and 2.6%, 2.9%, and 4.4% (entire proposed development) of the total, respectively or about 1 to 3 more cars per minute added to the intersection. This impact is very minor. Therefore, it is suggested that no improvements be required at this location based on the site's minimal impact.

If required by Government agencies, the addition of a second southbound MD 24 left turn lane and a second westbound Singer Road left turn lane would mitigate the site's impact but would still not provide acceptable levels of service. It is important to recognize, widening would be required along Singer Road in order to accommodate the second lane and right-of-way may be limited.

MD 924 at Singer Road

The intersection of MD 924 at Singer Road is projected to operate at Level of Service "E" conditions during the background and total traffic conditions during the Saturday midday peak periods using both the HCM and CLV Analyses. The proposed Walmart Retail Store adds 119 trips and the entire proposed development adds 132 trips during the Saturday midday peak hour out of a projected 3,061 trips which is 3.9% and 4.3% of the total, respectively or about 2 more cars per minute added to the intersection.

Therefore, it is suggested that no improvements be required based on the minimal impact and the since daily peak hour traffic conditions are acceptable.

If improvements are required, a third lane would be recommended along the eastbound approach of Singer Road. It is important to recognize, right-of-way may restrict the viability of this improvement. With the addition of a third lane, the intersection would feature one left, one through, and one right turn lane along this approach. This improvement would mitigate the site's impacts.

MD 924 at Bright Oaks Drive/Site Access

Traffic signalization is recommended to facilitate access to and egress from the site. In addition, a second through lane will be needed along northbound MD 924 within this road segment. A separate left turn lane is recommended along northbound 924. A separate right turn lane is needed along southbound MD 924. The site access approach should provide a shared left through lane and separate right turn lane.

TRIP GENERATION RATES

LAND USE FORMULA	DISTRIBUTION
Free-Standing Discount Superstore (ksf, ITE-813)	
Morning Trips = 1.67 x ksf	56/44
Evening Trips = 4.61 x ksf	49/51
Midday Sat. Trips = 5.64 x ksf	50/50
Convenience Market w/Gasoline Pumps (ksf, ITE-853)	
Morning Trips = 43.9 x ksf	50/50
Evening Trips = 59.69 x ksf	50/50
Midday Sat. Trips = 45.94 x ksf	51/49
High Turnover (Sit-Down) Rest. (ksf, ITE-932)	
Morning Trips = 11.52 x ksf	52/48
Evening Trips = 11.15 x ksf	59/41
Midday Sat. Trips = 20.00 x ksf	53/47
Quality Restaurant (ksf, ITE-931)	
Morning Trips = 0.81 x ksf	50/50
Evening Trips = 7.49 x ksf	67/33
Midday Sat. Trips = 10.82 x ksf	59/41
Drive-in Bank (ksf, ITE-912)	
Morning Trips = 12.35 x ksf	56/44
Evening Trips = 25.82 x ksf	50/50
Midday Sat. Trips = 26.53 x ksf	52/48

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Note: Trip generation rates derived from ITE Trip Generation, 8th Edition, 2008.

EXHIBIT 9
TRIP GENERATION RATES AND TOTALS
FOR SUBJECT SITE

qt, 110306\trips.xls-site (rate), f04/29/11

TRIP GENERATION TOTALS

	MORNING PEAK HOUR			EVENING PEAK HOUR			SAT. MIDDAY PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL
Wal-Mart Supercenter- South Bel Air									
189,564 sq.ft. Free-Standing Discount Superstore	178	139	317	428	446	874	545	524	1069
Less Internal Trips	-6	-6	-12	-11	-13	-24	-15	-17	-32
External Trips	*172*	*133*	*305*	*417*	*433*	*850*	*530*	*507*	*1,037*
Pass-by Trips (28%, 23%)				-117	-121	-238	-122	-117	-239
Net New Trips	***172***	***133***	***305***	***300***	***312***	***612***	***408***	***390***	***798***
4,500 sq.ft. Retail	3	2	5	8	9	17	11	11	22
Less Internal Trips	0	0	0	0	0	0	0	0	0
External Trips	*3*	*2*	*5*	*8*	*9*	*17*	*11*	*11*	*22*
Pass-by Trips (47%, 47%)				-3	-3	-6	-3	-3	-6
New Trips	***3***	***2***	***5***	***5***	***6***	***11***	***8***	***8***	***16***
4,880 sq.ft. Convenience Market w/Gasoline Pumps	107	107	214	145	146	291	114	110	224
Less Internal Trips	-6	-6	-12	-11	-12	-23	-12	-12	-24
External Trips	*101*	*101*	*202*	*134*	*134*	*268*	*102*	*98*	*200*
Pass-by Trips (63%, 66%, 66%)	-64	-64	-128	-88	-88	-176	-67	-65	-132
Net New Trips	***37***	***37***	***74***	***46***	***46***	***92***	***35***	***33***	***68***
16,000 sq.ft. High Turnover (Sit-Down) Rest.	96	88	184	105	73	178	119	106	225
Less Internal Trips	-6	-6	-12	-7	-6	-13	-9	-9	-18
External Trips	*90*	*82*	*172*	*98*	*67*	*165*	*110*	*97*	*207*
Pass-by Trips (43%, 43%)				-42	-29	-71	-47	-42	-89
Net New Trips	***90***	***82***	***172***	***56***	***38***	***94***	***63***	***55***	***118***
16,000 sq.ft. Quality Restaurant	6	7	13	80	40	120	102	71	173
Less Internal Trips	0	0	0	-6	-4	-10	-8	-6	-14
External Trips	*6*	*7*	*13*	*74*	*36*	*110*	*94*	*65*	*159*
Pass-by Trips (44%, 44%)				-33	-16	-49	-41	-29	-70
Net New Trips	***6***	***7***	***13***	***41***	***20***	***61***	***53***	***36***	***89***
Total — ***Pass-by Trips***	***64***	***64***	***128***	***283***	***257***	***540***	***280***	***256***	***536***
Total — ***Net New Trips***	***308***	***261***	***569***	***448***	***422***	***870***	***567***	***522***	***1089***

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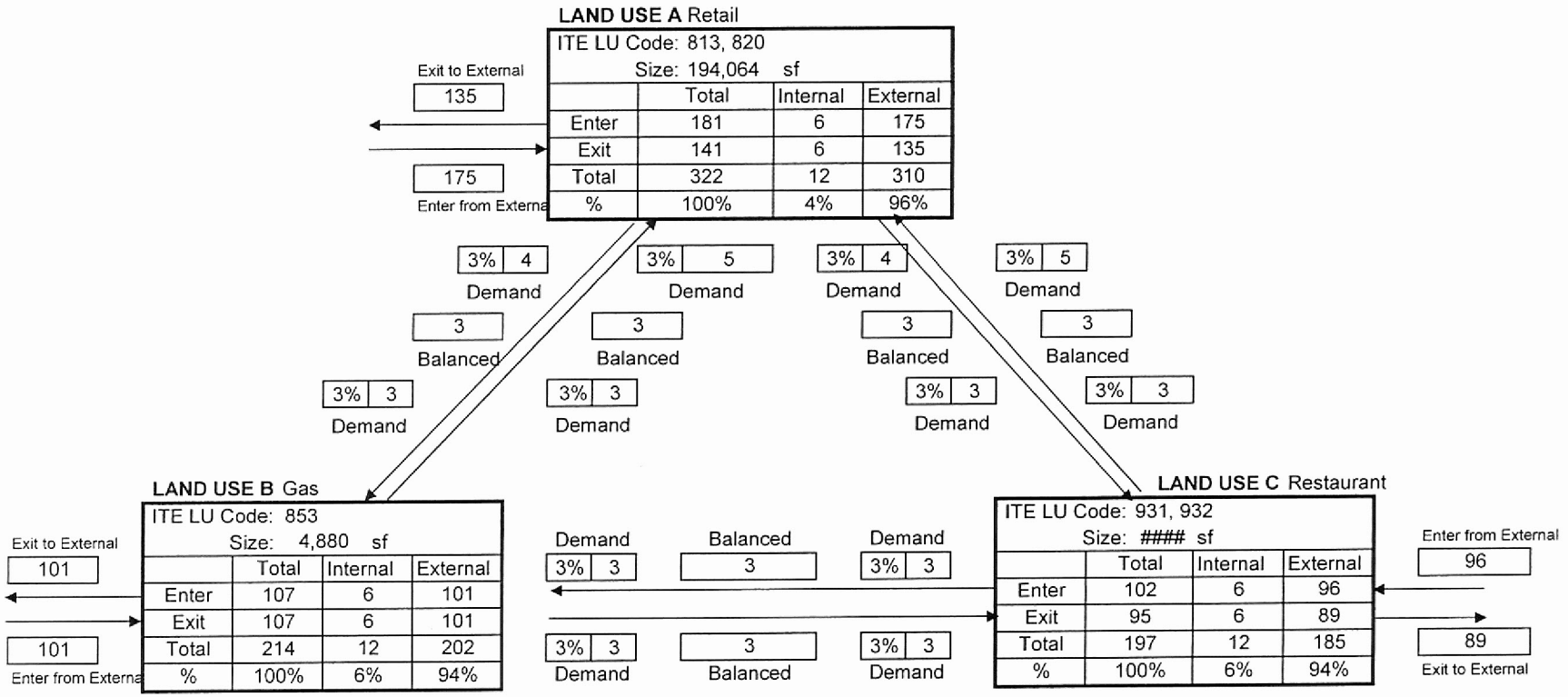
Note: 1. Trip generation rates and pass-by rates derived from ITE Trip Generation, 8th Edition, 2008 and ITE Trip Generation Handbook, Second Edition.
2. 5% overall internal trips are projected.

EXHIBIT 9 CONT'D
TRIP GENERATION RATES AND TOTALS
FOR SUBJECT SITE

qt, 110306\12maytrips12\june.xls-site (2), f06/05/12

Multi-Use Trip Generation Calculation

Name of Development: Wal-Mart Supercenter
Time Period: AM Peak Hour
Analyst: Qiang Tian
Date: 6/18/12

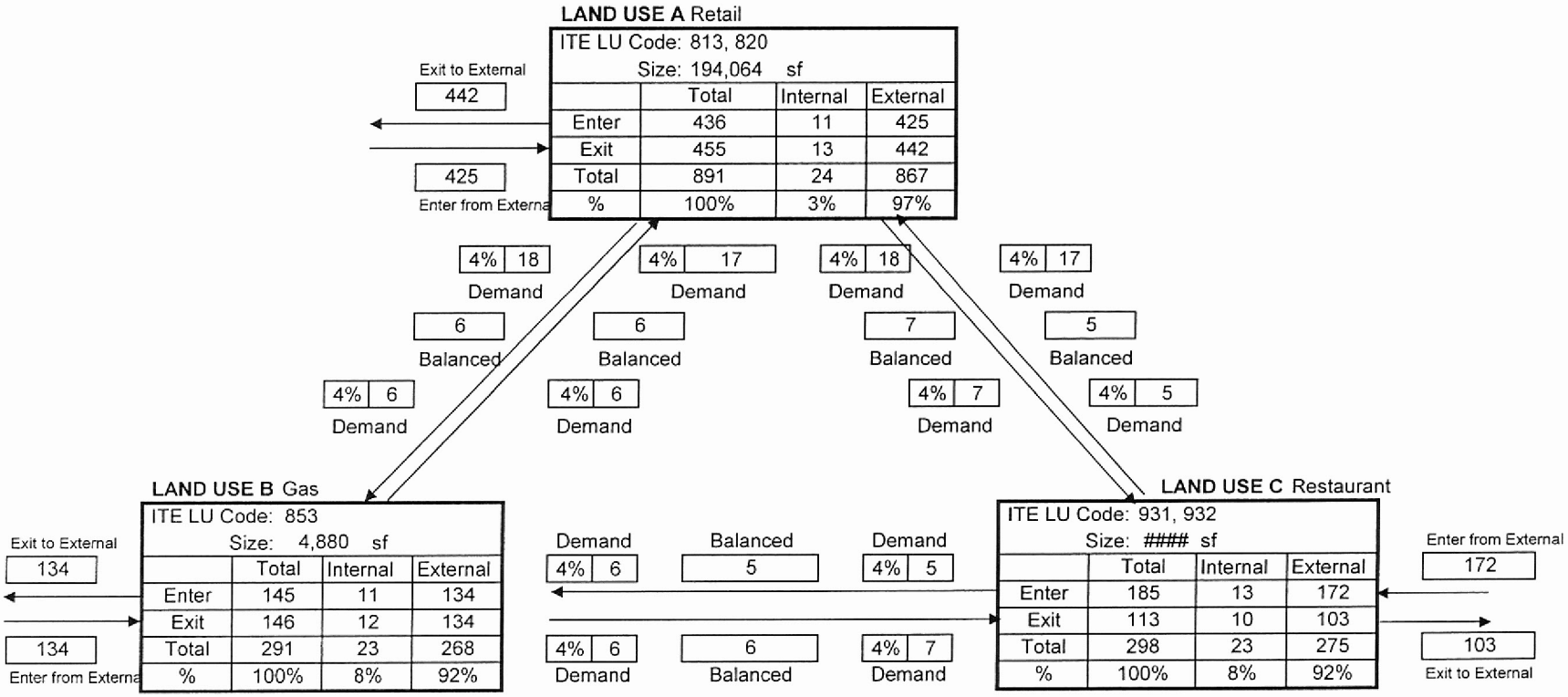


Net External Trips for Multi-Use Development

	LAND USE A	LAND USE B	LAND USE C	TOTAL	
Enter	175	101	96	372	
Exit	135	101	89	325	
Total	310	202	185	697	INTERNAL CAPTURE
Single-Use Trip Gen. Est.	322	214	197	733	5%

Multi-Use Trip Generation Calculation

Name of Development: Wal-Mart Supercenter
Time Period: PM Peak Hour
Analyst: Qiang Tian
Date: 6/18/12

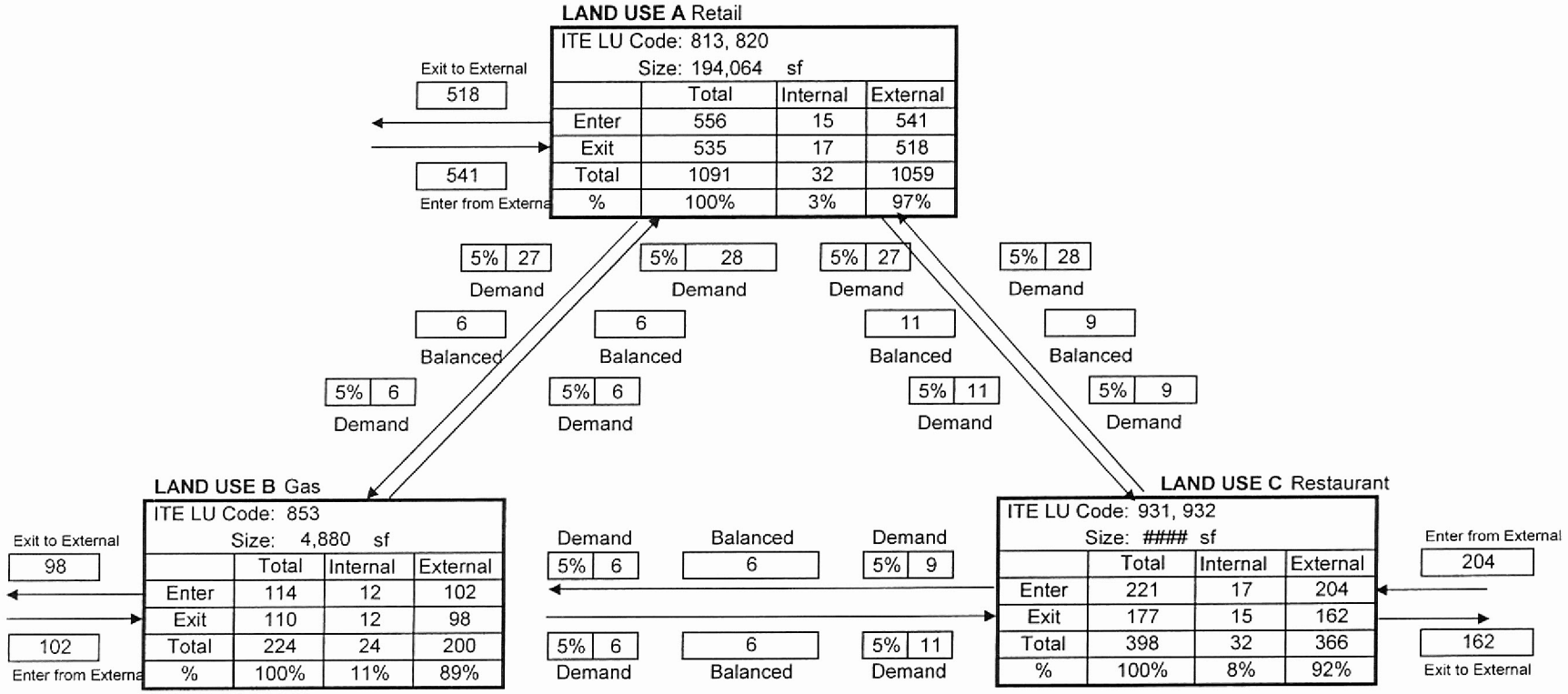


Net External Trips for Multi-Use Development

	LAND USE A	LAND USE B	LAND USE C	TOTAL	
Enter	425	134	172	731	
Exit	442	134	103	679	
Total	867	268	275	1410	INTERNAL CAPTURE
Single-Use Trip Gen. Est.	891	291	298	1480	5%

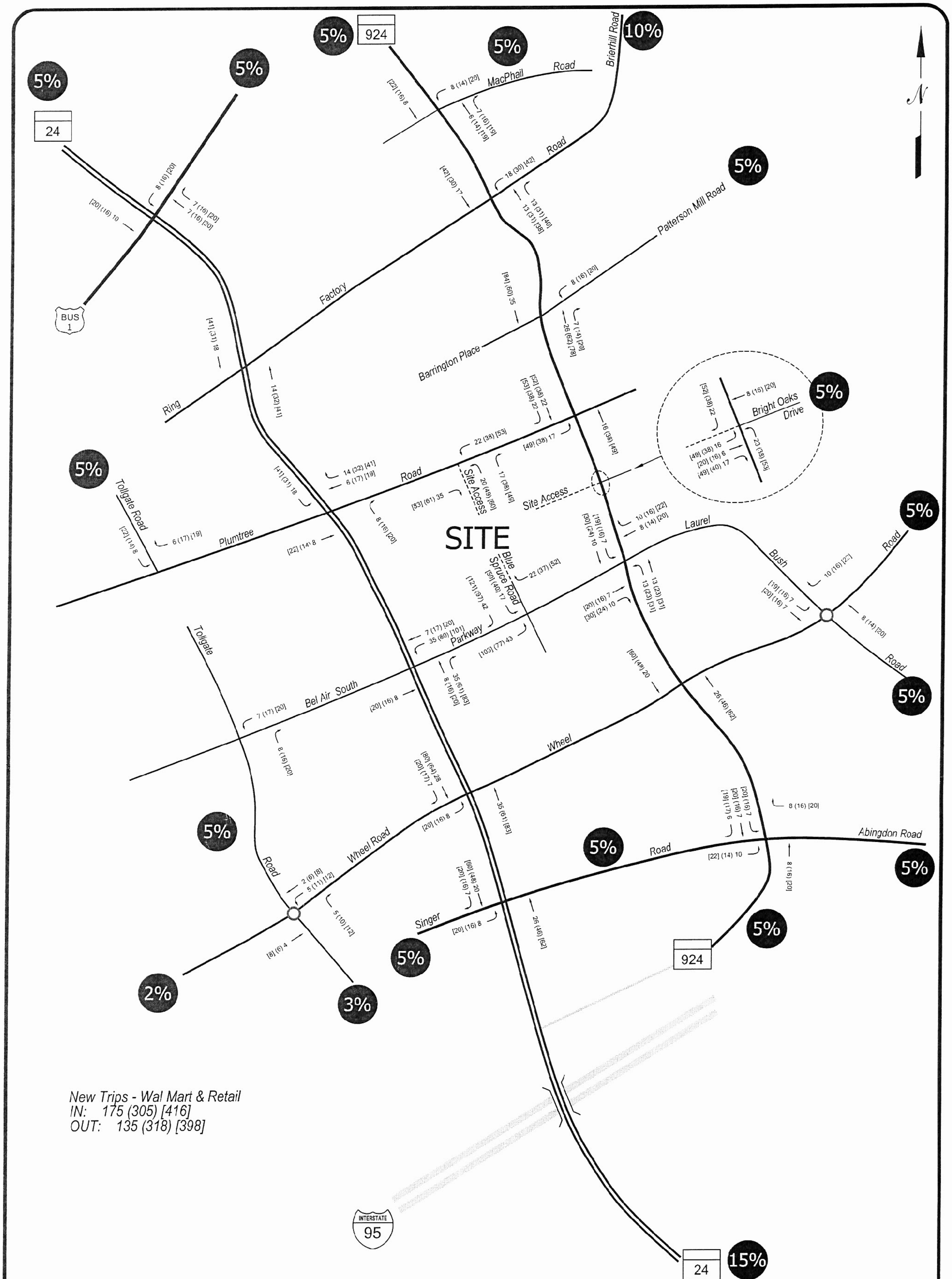
Multi-Use Trip Generation Calculation

Name of Development: Wal-Mart Supercenter
Time Period: Sat. Midday Peak Hour
Analyst: Qiang Tian
Date: 6/18/12



Net External Trips for Multi-Use Development

	LAND USE A	LAND USE B	LAND USE C	TOTAL	
Enter	541	102	204	847	
Exit	518	98	162	778	
Total	1059	200	366	1625	INTERNAL CAPTURE
Single-Use Trip Gen. Est.	1091	224	398	1713	5%



NOT TO SCALE

00 - MORNING PEAK HOUR
(00) - EVENING PEAK HOUR
[00] - SATURDAY MIDDAY PEAK HOUR

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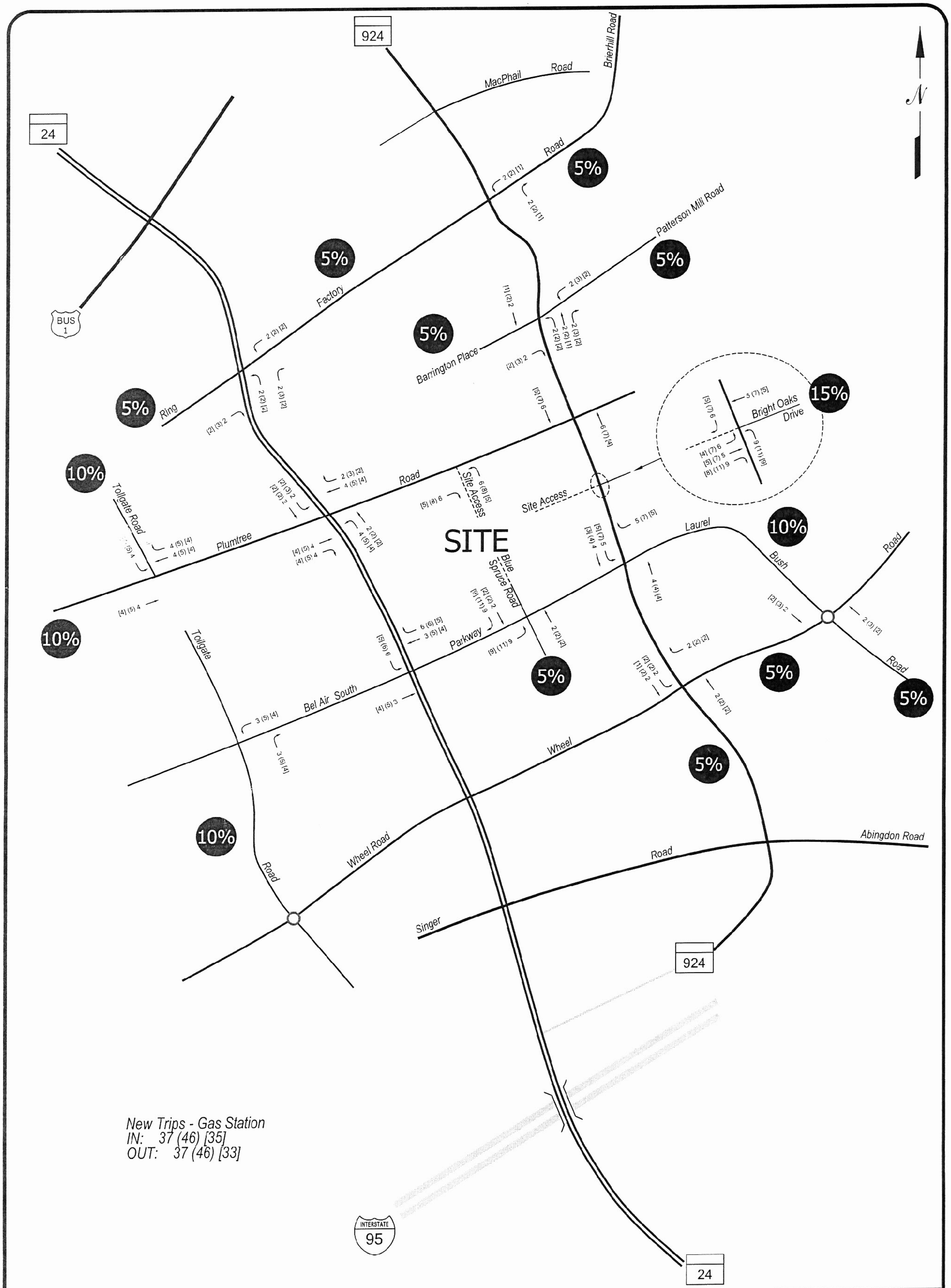
EXHIBIT 10A
TRIP DISTRIBUTION FOR SUBJECT SITE - WAL MART & RETAIL

33



NOT TO SCALE

00 - MORNING PEAK HOUR
(00) - EVENING PEAK HOUR
[00] - SATURDAY MIDDAY PEAK HOUR

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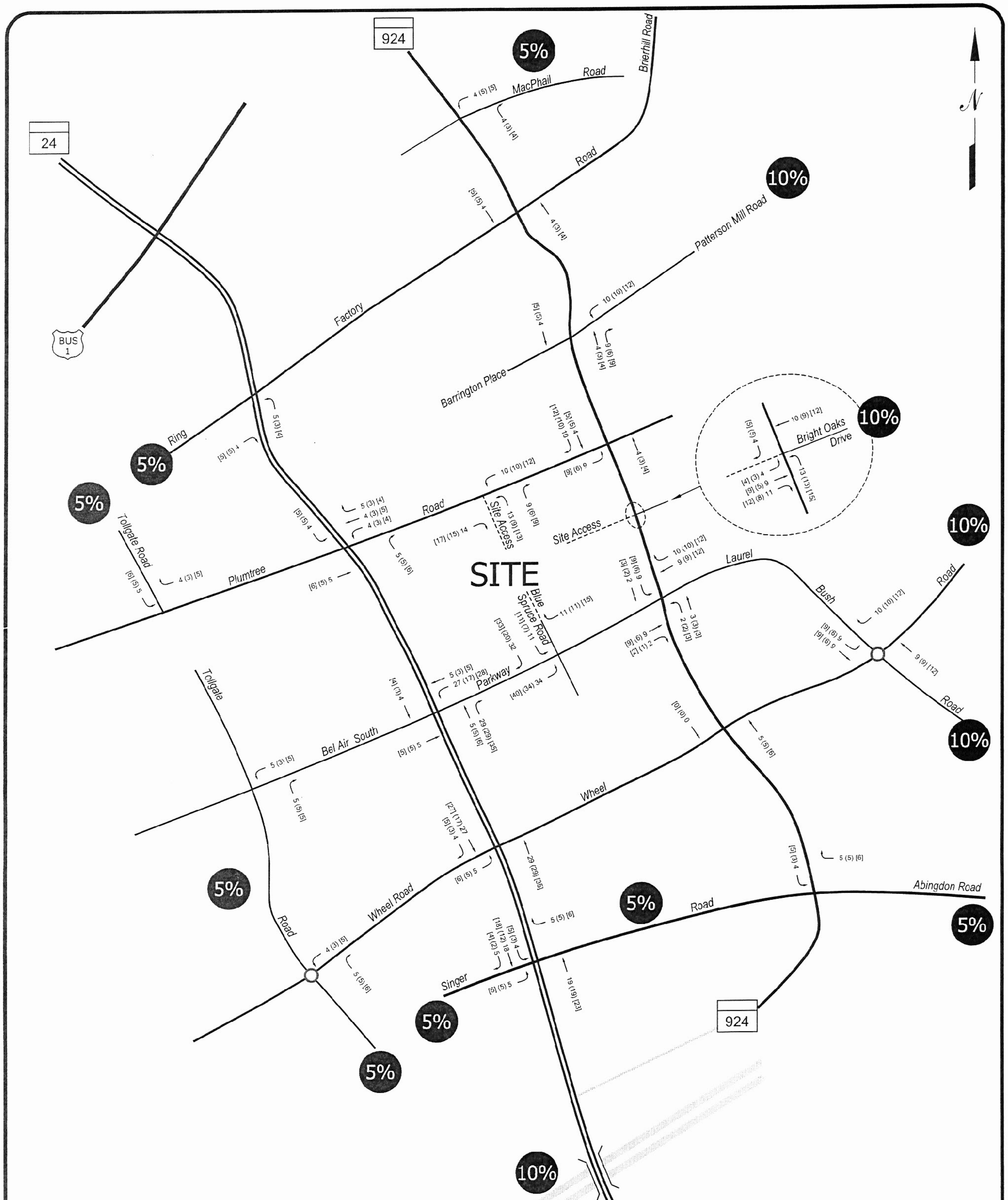
EXHIBIT 10B
TRIP DISTRIBUTION FOR
SUBJECT SITE - GAS STATION

2may\0531_12.cwg-stn-gas; f06/18/12



New Trips - Restaurant
IN: 96 (97) [116]
OUT: 89 (58) [91]

NOT TO SCALE

00 - MORNING PEAK HOUR
(00) - EVENING PEAK HOUR
[00] - SATURDAY MIDDAY PEAK HOUR

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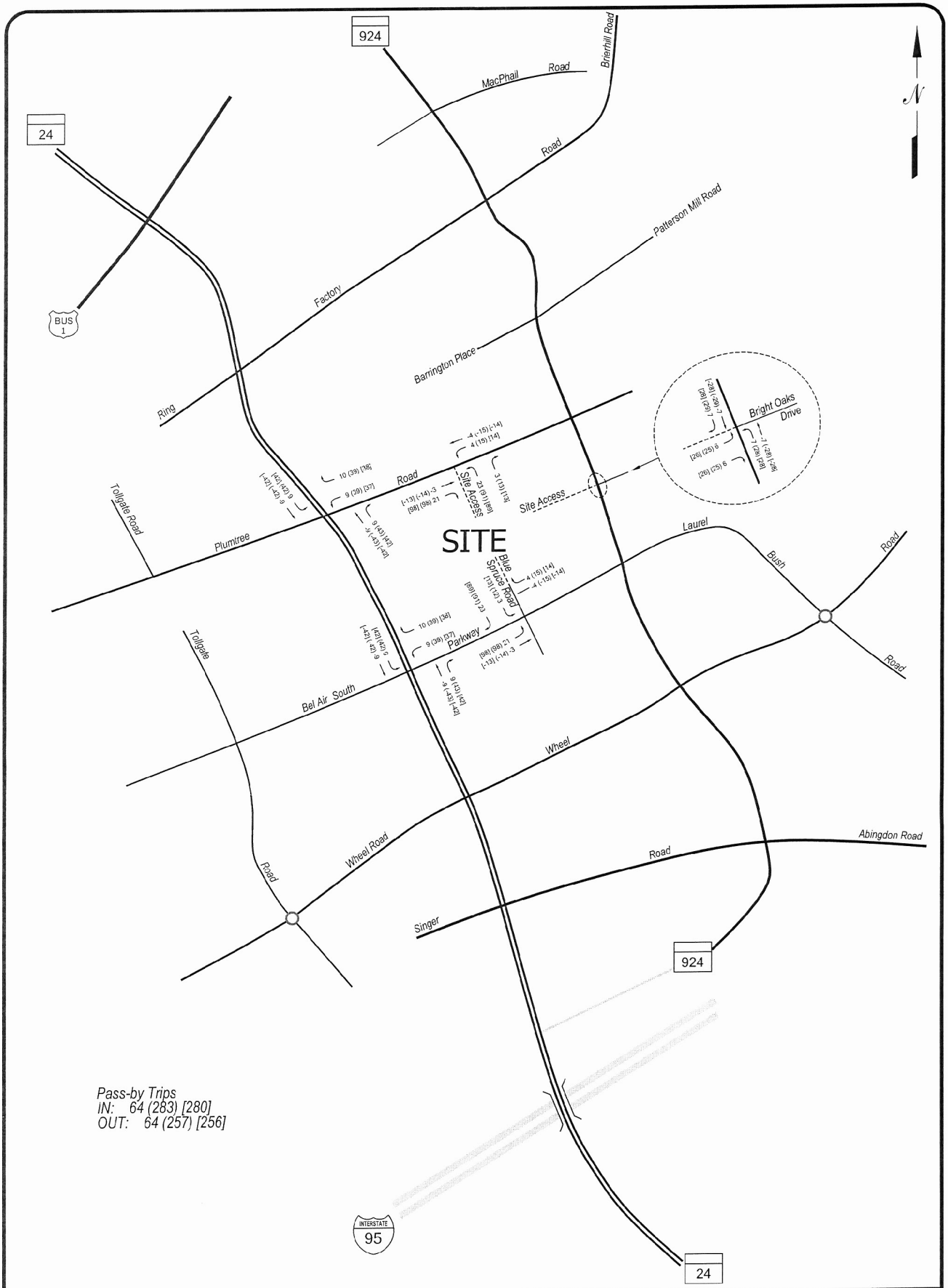
EXHIBIT 10C
TRIP DISTRIBUTION FOR
SUBJECT SITE - RESTAURANT

2may\0531_12 cwg-stn-res; f06/18/12

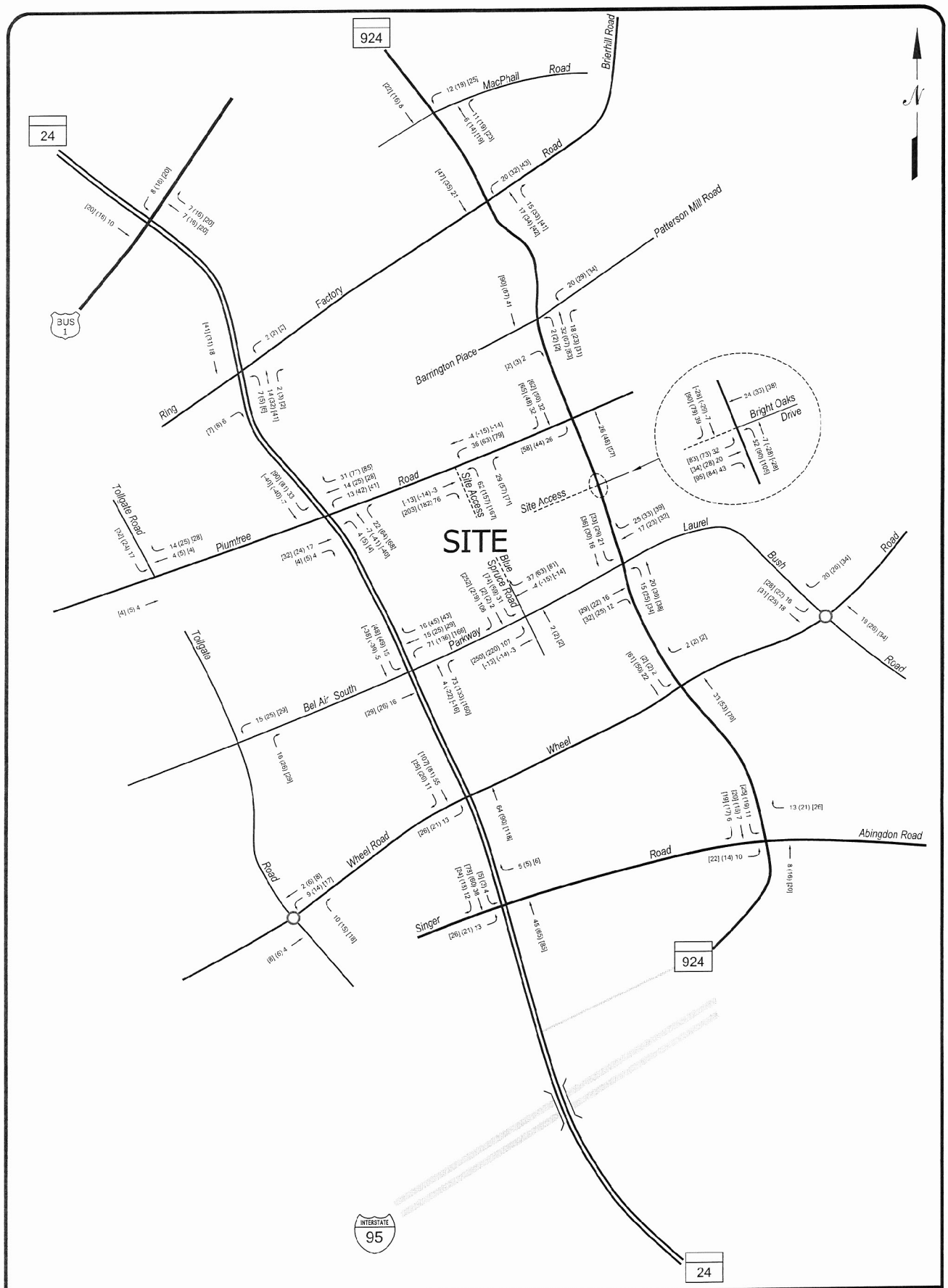


Pass-by Trips
IN: 64 (283) [280]
OUT: 64 (257) [256]

NOT TO SCALE

00 - MORNING PEAK HOUR
(00) - EVENING PEAK HOUR
[00] - SATURDAY MIDDAY PEAK HOUR

EXHIBIT 10D
PASS-BY TRIP ASSIGNMENT FOR SUBJECT SITE



NOT TO SCALE

00 - MORNING PEAK HOUR
(00) - EVENING PEAK HOUR
[00] - SATURDAY MIDDAY PEAK HOUR

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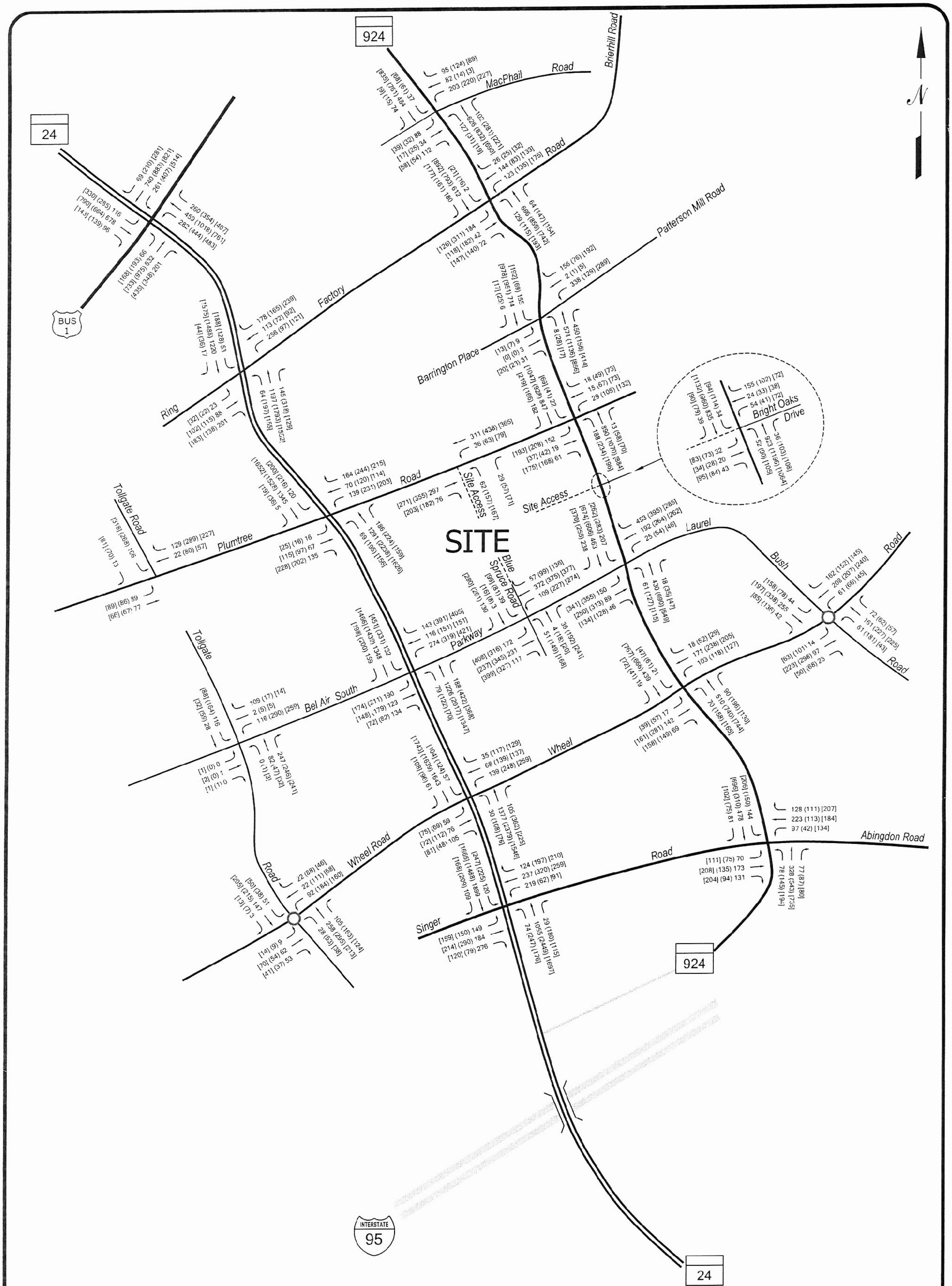
EXHIBIT 10E
COMBINED NEW TRIPS FOR SUBJECT SITE



NOT TO SCALE

00 - MORNING PEAK HOUR
(00) - EVENING PEAK HOUR
[00] - SATURDAY MIDDAY PEAK HOUR

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EXHIBIT 11
2015 TOTAL PEAK HOUR TRAFFIC VOLUMES

CLV Methodology	2012 Existing Traffic	2015 Background Traffic	2015 Total Traffic
Morning Peak Hour Traffic	**LOS / CLV**	**LOS / CLV**	**LOS / CLV**
1. Business US 1 & MD 24	A / 917	B / 1009	B / 1015
2. MD 924 & MacPhail Rd	B / 1097	C / 1182	C / 1211
with Improvements	---	---	***B / 1099***
3. MD 24 & Ring Factory Rd	A / 971	D / 1362	D / 1383
with Improvements	---	---	***C / 1241***
4. MD 924 & Ring Factory Rd	B / 1007	C / 1151	C / 1192
with Improvements	---	---	***B / 1069***
5. MD 924 & Patterson Mill Rd / Barrington Pl	A / 958	B / 1038	B / 1090
6. Plumtree Rd & Tollgate Rd	A / 351	A / 384	A / 419
7. MD 24 & Plumtree Rd	A / 882	B / 1003	B / 1068
with Improvements	---	---	***A / 984***
8. MD 924 & Plumtree Rd	B / 1027	B / 1144	C / 1202
with Improvements	---	---	***B / 1127***
9. Bel Air South Pkwy & Tollgate Rd	A / 506	A / 542	A / 575
10. MD 24 & Bel Air South Pkwy	A / 984	C / 1183	C / 1242
with Improvements	---	---	***B / 1107***
11. Bel Air South Pkwy & Blue Spruce Dr	A / 394	A / 428	A / 635
with Improvements	---	---	***A / 507***
12. MD 924 & Bel Air South Pkwy	A / 927	B / 1006	B / 1051
with Improvements	---	---	***A / 860***
14. MD 24 & Wheel Rd	A / 954	C / 1164	C / 1208
with Improvements	---	---	***B / 1149***
15. MD 924 & Wheel Rd	A / 742	A / 820	A / 845
17. MD 24 & Singer Rd	C / 1269	E / 1519	E / 1539
with Improvements	---	---	***E / 1504***
18. MD 924 & Singer Rd	A / 842	A / 950	A / 977
with Improvements	---	---	***A / 977***
19. Plumtree Rd & Site Access	---	---	A / 395
20. MD 924 & Bright Oaks Dr / Site Access	B / 1003	B / 1085	
with Improvements	---	---	***B / 1040***

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Exhibit 16 illustrates all improvements.

EXHIBIT 12
RESULTS OF INTERSECTION
CAPACITY ANALYSES (CLV)

CLV Methodology	2012 Existing Traffic	2015 Background Traffic	2015 Total Traffic
Evening Peak Hour Traffic	**LOS / CLV**	**LOS / CLV**	**LOS / CLV**
1. Business US 1 & MD 24	D / 1366	E / 1493	E / 1511
2. MD 924 & MacPhail Rd	D / 1321	E / 1456	E / 1508
with Improvements	---	---	***E / 1454***
3. MD 24 & Ring Factory Rd	C / 1180	D / 1381	D / 1402
with Improvements	---	---	***D / 1420***
4. MD 924 & Ring Factory Rd	C / 1214	D / 1381	D / 1448
with Improvements	---	---	***D / 1365***
5. MD 924 & Patterson Mill Rd / Barrington Pl	B / 1104	C / 1246	D / 1342
6. Plumtree Rd & Tollgate Rd	A / 668	A / 739	A / 793
7. MD 24 & Plumtree Rd	D / 1447	F / 1682	F / 1807
with Improvements	---	---	***F / 1613***
8. MD 924 & Plumtree Rd	C / 1279	D / 1427	E / 1477
with Improvements	---	---	***D / 1386***
9. Bel Air South Pkwy & Tollgate Rd	A / 680	A / 729	A / 782
10. MD 24 & Bel Air South Pkwy	E / 1465	F / 1693	F / 1824
with Improvements	---	---	***F / 1678***
11. Bel Air South Pkwy & Blue Spruce Dr	A / 743	A / 827	C / 1157
with Improvements	---	---	***A / 974***
12. MD 924 & Bel Air South Pkwy	D / 1370	E / 1545	F / 1627
with Improvements	---	---	***C / 1228***
14. MD 24 & Wheel Rd	E / 1538	F / 1799	F / 1869
with Improvements	---	---	***F / 1792***
15. MD 924 & Wheel Rd	C / 1202	D / 1363	D / 1413
17. MD 24 & Singer Rd	F / 1663	F / 1982	F / 2042
with Improvements	---	---	***F / 1952***
18. MD 924 & Singer Rd	A / 766	A / 929	A / 992
with Improvements	---	---	***A / 992***
19. Plumtree Rd & Site Access	---	---	A / 595
20. MD 924 & Bright Oaks Dr / Site Access	C / 1216	D / 1379	
with Improvements	---	---	***C / 1201***

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EXHIBIT 12 CONT'D
RESULTS OF INTERSECTION
CAPACITY ANALYSES (CLV)

CLV Methodology	2012 Existing Traffic	2015 Background Traffic	2015 Total Traffic
Saturday Midday Peak Hour Traffic	LOS / CLV	LOS / CLV	LOS / CLV
1. Business US 1 & MD 24	C / 1277	D / 1413	D / 1436
2. MD 924 & MacPhail Rd	B / 1125	C / 1257	D / 1324
with Improvements	---	---	***C / 1266***
3. MD 24 & Ring Factory Rd	B / 1117	D / 1381	D / 1408
with Improvements	---	---	***D / 1389***
4. MD 924 & Ring Factory Rd	C / 1281	E / 1568	F / 1658
with Improvements	---	---	***E / 1525***
5. MD 924 & Patterson Mill Rd / Barrington Pl	B / 1081	C / 1244	D / 1361
6. Plumtree Rd & Tollgate Rd	A / 625	A / 708	A / 772
7. MD 24 & Plumtree Rd	C / 1177	D / 1378	E / 1462
with Improvements	---	---	***D / 1327***
8. MD 924 & Plumtree Rd	D / 1334	E / 1525	E / 1587
with Improvements	---	---	***D / 1431***
9. Bel Air South Pkwy & Tollgate Rd	A / 552	A / 594	A / 655
10. MD 24 & Bel Air South Pkwy	C / 1191	D / 1394	E / 1548
with Improvements	---	---	***D / 1413***
11. Bel Air South Pkwy & Blue Spruce Dr	A / 712	A / 784	D / 1352
with Improvements	---	---	***B / 1145***
12. MD 924 & Bel Air South Pkwy	C / 1260	E / 1458	E / 1561
with Improvements	---	---	***C / 1256***
14. MD 24 & Wheel Rd	B / 1126	D / 1363	D / 1448
with Improvements	---	---	***D / 1369***
15. MD 924 & Wheel Rd	C / 1178	D / 1389	D / 1450
17. MD 24 & Singer Rd	C / 1244	E / 1521	E / 1598
with Improvements	---	---	***E / 1510***
18. MD 924 & Singer Rd	C / 1154	D / 1442	E / 1487
with Improvements	---	---	***D / 1443***
19. Plumtree Rd & Site Access	---	---	A / 532
20. MD 924 & Bright Oaks Dr / Site Access	B / 1074	C / 1258	
with Improvements	---	---	***D / 1437***

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EXHIBIT 12 CONT'D
RESULTS OF INTERSECTION
CAPACITY ANALYSES (CLV)

HCS Analysis

Morning Peak Hour Traffic	Control Type	2012 Existing Traffic	2015 Background Traffic	2015 Total Traffic
		LOS / DELAY	LOS / DELAY	LOS / DELAY
1. Business US 1 & MD 24	Signal	C / 22.8	C / 24.9	C / 25.1
2. MD 924 & MacPhail Rd	Signal	C / 24.1	C / 34.5	D / 42.3
with Improvements		---	---	***C / 28.6***
3. MD 24 & Ring Factory Rd	Signal	F / 172.1	F / 264.5	F / 266.6
with Improvements		---	---	***D / 50.9***
4. MD 924 & Ring Factory Rd	Signal	C / 21.4	C / 30.8	C / 34.6
with Improvements		---	---	***C / 23.9***
5. MD 924 & Patterson Mill Rd / Barrington Pl	Signal	C / 20.3	C / 25.0	C / 29.6
6. Plumtree Rd & Tollgate Rd	Two-Way Stop	B / 12.4	B / 13.0	B / 13.7
7. MD 24 & Plumtree Rd	Signal	B / 16.5	B / 19.3	C / 21.8
with Improvements		---	---	***C / 24.7***
8. MD 924 & Plumtree Rd	Signal	A / 8.0	A / 9.3	B / 10.6
with Improvements		---	---	***B / 19.8***
9. Bel Air South Pkwy & Tollgate Rd	Two-Way Stop	B / 12.2	B / 12.3	B / 13.3
10. MD 24 & Bel Air South Pkwy	Signal	C / 27.3	C / 31.9	D / 37.8
with Improvements		---	---	***C / 24.2***
11. Bel Air South Pkwy & Blue Spruce Dr	Two-Way Stop	C / 25.0	D / 29.5	F / 81.4
with Improvements	***Signal***	---	---	***B / 19.2***
12. MD 924 & Bel Air South Pkwy	Signal	C / 29.3	C / 31.7	D / 39.4
with Improvements		---	---	***C / 27.9***
13. Wheel Rd & Tollgate Road	Roundabout	A / 7.9	A / 8.6	A / 8.9
v/c ratio		*0.48*	*0.52*	*0.54*
14. MD 24 & Wheel Rd	Signal	B / 16.8	B / 17.8	B / 18.7
with Improvements		---	---	***B / 17.4***
15. MD 924 & Wheel Rd	Signal	B / 17.4	B / 18.0	B / 18.3
16. Wheel Rd & Laurel Bush Rd	Roundabout	A / 8.2	A / 8.8	A / 9.4
v/c ratio		*0.44*	*0.48*	*0.51*
17. MD 24 & Singer Rd	Signal	C / 25.2	D / 39.0	D / 41.8
with Improvements		---	---	***D / 45.0***
18. MD 924 & Singer Rd	Signal	B / 18.4	C / 20.4	C / 20.6
with Improvements		---	---	***B / 18.7***
19. Plumtree Rd & Site Access	Two-Way Stop			B / 14.7
20. MD 924 & Bright Oaks Dr / Site Access	Two-Way Stop	C / 24.9	D / 30.7	F / 324.3
with Improvements	***Signal***	---	---	***D / 40.4***

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EXHIBIT 13
RESULTS OF INTERSECTION
CAPACITY ANALYSES (HCM)

HCS Analysis

Evening Peak Hour Traffic	Control Type	2012 Existing Traffic	2015 Background Traffic	2015 Total Traffic
		LOS / DELAY	LOS / DELAY	LOS / DELAY
1. Business US 1 & MD 24	Signal	D / 43.4	D / 51.1	D / 51.1
2. MD 924 & MacPhail Rd	Signal	B / 16.8	C / 31.4	D / 36.8
with Improvements		---	---	***D / 38.5***
3. MD 24 & Ring Factory Rd	Signal	C / 22.6	D / 35.5	D / 35.8
with Improvements		---	---	***D / 36.8***
4. MD 924 & Ring Factory Rd	Signal	C / 23.9	D / 37.6	D / 44.8
with Improvements		---	---	***C / 34.1***
5. MD 924 & Patterson Mill Rd / Barrington Pl	Signal	B / 13.4	B / 19.3	C / 33.2
6. Plumtree Rd & Tollgate Rd	Two-Way Stop	C / 16.6	C / 19.6	C / 22.8
7. MD 24 & Plumtree Rd	Signal	C / 33.8	E / 60.4	E / 68.6
with Improvements		---	---	***D / 54.2***
8. MD 924 & Plumtree Rd	Signal	B / 18.7	C / 21.0	D / 37.8
with Improvements		---	---	***D / 37.8***
9. Bel Air South Pkwy & Tollgate Rd	Two-Way Stop	C / 25.0	D / 31.0	E / 38.0
10. MD 24 & Bel Air South Pkwy	Signal	C / 31.1	E / 59.0	E / 66.6
with Improvements		---	---	***D / 52.7***
11. Bel Air South Pkwy & Blue Spruce Dr	Two-Way Stop	F / 346.7	F / 598.6	F > 999.9
with Improvements	***Signal***	---	---	***C / 29.3***
12. MD 924 & Bel Air South Pkwy	Signal	E / 73.0	F / 98.1	F / 113.5
with Improvements		---	---	***D / 37.8***
13. Wheel Rd & Tollgate Road	Roundabout	A / 9.4	B / 10.8	B / 11.4
v/c ratio		*0.49*	*0.55*	*0.57*
14. MD 24 & Wheel Rd	Signal	D / 36.5	E / 77.0	F / 87.5
with Improvements		---	---	***E / 69.0***
15. MD 924 & Wheel Rd	Signal	C / 27.6	D / 36.7	D / 43.9
16. Wheel Rd & Laurel Bush Rd	Roundabout	C / 16.0	C / 19.6	C / 23.4
v/c ratio		*0.68*	*0.76*	*0.83*
17. MD 24 & Singer Rd	Signal	E / 63.8	F / 121.6	F / 132.2
with Improvements		---	---	***F / 116.0***
18. MD 924 & Singer Rd	Signal	B / 17.2	C / 20.9	C / 21.9
with Improvements		---	---	***C / 20.3***
19. Plumtree Rd & Site Access	Two-Way Stop			D / 31.4
20. MD 924 & Bright Oaks Dr / Site Access	Two-Way Stop	D / 31.4	E / 45.4	F > 999.9
with Improvements	***Signal***	---	---	***D / 36.7***

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EXHIBIT 13 CONT'D
RESULTS OF INTERSECTION
CAPACITY ANALYSES (HCM)

HCS Analysis

Saturday Midday Peak Hour Traffic	Control Type	2012 Existing Traffic	2015 Background Traffic	2015 Total Traffic
		LOS / DELAY	LOS / DELAY	LOS / DELAY
1. Business US 1 & MD 24	Signal	D / 35.2	D / 42.9	D / 44.4
2. MD 924 & MacPhail Rd	Signal	B / 14.0	C / 20.1	C / 25.9
with Improvements		---	---	***C / 26.1***
3. MD 24 & Ring Factory Rd	Signal	C / 34.1	E / 59.9	E / 62.4
with Improvements		---	---	***D / 54.0***
4. MD 924 & Ring Factory Rd	Signal	C / 28.7	E / 73.7	F / 90.5
with Improvements		---	---	***E / 63.8***
5. MD 924 & Patterson Mill Rd / Barrington Pl	Signal	C / 32.9	E / 70.5	F / 107.9
6. Plumtree Rd & Tollgate Rd	Two-Way Stop	C / 16.5	C / 20.3	C / 24.8
7. MD 24 & Plumtree Rd	Signal	C / 21.0	C / 30.1	D / 38.6
with Improvements		---	---	***C / 28.4***
8. MD 924 & Plumtree Rd	Signal	B / 19.4	C / 21.6	C / 33.5
with Improvements		---	---	***D / 36.6***
9. Bel Air South Pkwy & Tollgate Rd	Two-Way Stop	B / 14.9	C / 16.1	C / 17.8
10. MD 24 & Bel Air South Pkwy	Signal	C / 29.2	C / 33.8	D / 46.6
with Improvements		---	---	***C / 30.4***
11. Bel Air South Pkwy & Blue Spruce Dr	Two-Way Stop	F / 754.7	F > 999.9	F > 999.9
with Improvements	***Signal***	---	---	***D / 46.3***
12. MD 924 & Bel Air South Pkwy	Signal	D / 37.7	E / 59.8	E / 76.1
with Improvements		---	---	***C / 29.7***
13. Wheel Rd & Tollgate Road	Roundabout	A / 6.7	A / 7.5	A / 7.8
v/c ratio		*0.33*	*0.38*	*0.39*
14. MD 24 & Wheel Rd	Signal	C / 25.4	C / 31.8	C / 33.1
with Improvements		---	---	***C / 25.6***
15. MD 924 & Wheel Rd	Signal	C / 22.6	C / 29.3	C / 34.4
16. Wheel Rd & Laurel Bush Rd	Roundabout	A / 9.7	B / 11.0	B / 12.6
v/c ratio		*0.44*	*0.50*	*0.57*
17. MD 24 & Singer Rd	Signal	C / 23.9	C / 33.5	D / 38.2
with Improvements		---	---	***D / 38.0***
18. MD 924 & Singer Rd	Signal	C / 27.5	E / 76.4	E / 78.8
with Improvements		---	---	***D / 44.3***
19. Plumtree Rd & Site Access	Two-Way Stop			D / 26.7
20. MD 924 & Bright Oaks Dr / Site Access	Two-Way Stop	D / 30.4	F / 52.0	F > 999.9
with Improvements	***Signal***	---	---	***D / 50.9***

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EXHIBIT 13 CONT'D
RESULTS OF INTERSECTION
CAPACITY ANALYSES (HCM)

Arterial MD 924	Existing Traffic	Background Traffic	Total Traffic	Total Traffic w/ Improvements
NB (from Wheel Road to Patterson Mill Road)	**Arterial Level of Service**			
Morning Peak Hour Traffic				
Travel time (s):	152	154	163	158
Arterial Speed (mph)	26	26	24	25
Evening Peak Hour Traffic				
Travel time (s):	251	373	580	224
Arterial Speed (mph)	16	12	11	18
Saturday Midday Peak Hour Traffic				
Travel time (s):	190	379	330	216
Arterial Speed (mph)	21	12	13	20
SB (from Patterson Mill Road to Wheel Road)	**Arterial Level of Service**			
Morning Peak Hour Traffic				
Travel time (s):	141	142	146	159
Arterial Speed (mph)	28	27	27	25
Evening Peak Hour Traffic				
Travel time (s):	170	194	178	200
Arterial Speed (mph)	23	20	22	20
Saturday Midday Peak Hour Traffic				
Travel time (s):	171	223	218	205
Arterial Speed (mph)	23	18	18	19

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EXHIBIT 14
RESULTS OF ARTERIAL ANALYSES (SIMTRAFFIC)

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SimTraffic (5 runs)	Existing Traffic	Background Traffic	Total Traffic	Total Traffic w/ Improvements	*Available Storage Length (ft.)*
Morning Peak Hour Traffic	95th percentile queue (ft.)				
5. MD 924 & Patterson Mill Rd / Barrington Pl					
Eastbound Barrington Pl right turn:	40	40	44	44	*n/a*
Westbound Patterson Mill Rd left turn:	229	231	236	238	*110*
Northbound MD 924 left turn:	<25	<25	<25	<25	*170*
Northbound MD 924 right turn:	87	95	123	163	*240*
Southbound MD 924 left turn:	108	118	127	131	*n/a*
Southbound MD 924 right turn:	<25	<25	<25	<25	*230*
8. MD 924 & Plumtree Rd					
Eastbound Plumtree Rd left turn:	107	193	209	243	*n/a*
Westbound Plumtree Rd left turn:	70	63	59	60	*n/a*
Westbound Plumtree Rd right turn:	30	32	33	35	*n/a*
Northbound MD 924 left turn:	133	139	147	116	*500*
Northbound MD 924 right turn:	<25	<25	<25	<25	*500*
Southbound MD 924 left turn:	38	99	36	52	*500*
Southbound MD 924 right turn:	42	41	40	87	*n/a*
20. MD 924 & Bright Oaks Dr / Site Access					
Eastbound Site Access left turn:			384	73	*n/a*
Eastbound Site Access right turn:			287	49	*n/a*
Westbound Bright Oaks Dr left turn:	117	169	500	101	*n/a*
Westbound Bright Oaks Dr right turn:	111	159	391	85	*190*
Northbound MD 924 left turn:			45	53	*n/a*
Northbound MD 924 right turn:	<25	<25	<25	<25	*160*
Southbound MD 924 left turn:	45	47	47	47	*250*
Southbound MD 924 right turn:			<25	<25	*n/a*
12. MD 924 & Bel Air South Pkwy					
Eastbound Bel Air South Pkwy left turn:	156	157	221	98	*n/a*
Eastbound Bel Air South Pkwy right turn:	39	37	35		*n/a*
Westbound Bel Air South Pkwy left turn:	50	52	45	52	*160*
Westbound Bel Air South Pkwy right turn:	205	222	280	172	*210*
Northbound MD 924 left turn:	50	48	57	62	*500*
Southbound MD 924 left turn:	135	160	150	128	*n/a*
Southbound MD 924 right turn:	55	58	54	49	*500*
15. MD 924 & Wheel Rd					
Eastbound Wheel Rd left turn:	29	28	25	25	*350*
Westbound Wheel Rd left turn:	96	104	99	96	*210*
Northbound MD 924 left turn:	42	50	52	48	*120*
Northbound MD 924 right turn:	41	43	41	41	*330*

SimTraffic (5 runs)	Existing Traffic	Background Traffic	Total Traffic	Total Traffic w/ Improvements	*Available Storage Length (ft.)*
Evening Peak Hour Traffic	**95th percentile queue (ft.)**				
5. MD 924 & Patterson Mill Rd / Barrington Pl					
Eastbound Barrington Pl right turn:	39	38	41	43	*n/a*
Westbound Patterson Mill Rd left turn:	124	145	191	176	*110*
Northbound MD 924 left turn:	26	34	30	80	*170*
Northbound MD 924 right turn:	<25	<25	<25	107	*240*
Southbound MD 924 left turn:	58	46	51	75	*n/a*
Southbound MD 924 right turn:	<25	<25	<25	<25	*230*
8. MD 924 & Plumtree Rd					
Eastbound Plumtree Rd left turn:	211	248	302	310	*n/a*
Westbound Plumtree Rd left turn:	161	254	262	145	*n/a*
Westbound Plumtree Rd right turn:	51	54	59	68	*n/a*
Northbound MD 924 left turn:	247	321	252	370	*500*
Northbound MD 924 right turn:	27	29	<25	173	*500*
Southbound MD 924 left turn:	62	55	48	147	*500*
Southbound MD 924 right turn:	37	47	95	52	*n/a*
20. MD 924 & Bright Oaks Dr / Site Access					
Eastbound Site Access left turn:			379	191	*n/a*
Eastbound Site Access right turn:			422	80	*n/a*
Westbound Bright Oaks Dr left turn:	177	519	457	119	*n/a*
Westbound Bright Oaks Dr right turn:	169	242	249	109	*190*
Northbound MD 924 left turn:			55	94	*n/a*
Northbound MD 924 right turn:	<25	<25	<25	112	*160*
Southbound MD 924 left turn:	108	162	79	104	*250*
Southbound MD 924 right turn:			<25	<25	*n/a*
12. MD 924 & Bel Air South Pkwy					
Eastbound Bel Air South Pkwy left turn:	372	350	365	603	*n/a*
Eastbound Bel Air South Pkwy right turn:	202	377	580		*n/a*
Westbound Bel Air South Pkwy left turn:	119	231	182	136	*160*
Westbound Bel Air South Pkwy right turn:	349	362	354	290	*210*
Northbound MD 924 left turn:	310	469	491	131	*500*
Southbound MD 924 left turn:	368	454	396	308	*n/a*
Southbound MD 924 right turn:	183	185	128	76	*500*
15. MD 924 & Wheel Rd					
Eastbound Wheel Rd left turn:	66	243	238	339	*350*
Westbound Wheel Rd left turn:	119	318	293	226	*210*
Northbound MD 924 left turn:	183	243	268	197	*120*
Northbound MD 924 right turn:	144	322	430	233	*330*

SimTraffic (5 runs)	Existing Traffic	Background Traffic	Total Traffic	Total Traffic w/ Improvements	*Available Storage Length (ft.)*
Saturday Midday Peak Hour Traffic	**95th percentile queue (ft.)**				
5. MD 924 & Patterson Mill Rd / Barrington Pl					
Eastbound Barrington Pl right turn:	26	35	39	38	*n/a*
Westbound Patterson Mill Rd left turn:	223	244	244	245	*110*
Northbound MD 924 left turn:	48	47	47	113	*170*
Northbound MD 924 right turn:	134	187	135	272	*240*
Southbound MD 924 left turn:	148	240	333	407	*n/a*
Southbound MD 924 right turn:	<25	45	83	<25	*230*
8. MD 924 & Plumtree Rd					
Eastbound Plumtree Rd left turn:	168	211	290	470	*n/a*
Westbound Plumtree Rd left turn:	214	327	338	204	*n/a*
Westbound Plumtree Rd right turn:	57	98	99	83	*n/a*
Northbound MD 924 left turn:	236	386	423	377	*500*
Northbound MD 924 right turn:	25	206	281	88	*500*
Southbound MD 924 left turn:	69	159	123	402	*500*
Southbound MD 924 right turn:	44	257	233	225	*n/a*
20. MD 924 & Bright Oaks Dr / Site Access					
Eastbound Site Access left turn:			381	302	*n/a*
Eastbound Site Access right turn:			348	118	*n/a*
Westbound Bright Oaks Dr left turn:	414	486	433	261	*n/a*
Westbound Bright Oaks Dr right turn:	225	242	163	133	*190*
Northbound MD 924 left turn:			142	143	*n/a*
Northbound MD 924 right turn:	<25	77	53	35	*160*
Southbound MD 924 left turn:	67	87	77	103	*250*
Southbound MD 924 right turn:			<25	114	*n/a*
12. MD 924 & Bel Air South Pkwy					
Eastbound Bel Air South Pkwy left turn:	376	383	349	267	*n/a*
Eastbound Bel Air South Pkwy right turn:	71	412	467		*n/a*
Westbound Bel Air South Pkwy left turn:	114	153	183	231	*160*
Westbound Bel Air South Pkwy right turn:	237	306	388	267	*210*
Northbound MD 924 left turn:	101	425	458	180	*500*
Southbound MD 924 left turn:	284	263	289	297	*n/a*
Southbound MD 924 right turn:	139	142	102	217	*500*
15. MD 924 & Wheel Rd					
Eastbound Wheel Rd left turn:	90	166	221	391	*350*
Westbound Wheel Rd left turn:	129	216	272	247	*210*
Northbound MD 924 left turn:	137	258	252	362	*120*
Northbound MD 924 right turn:	44	275	293	51	*330*

SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	*Available Storage Length (ft.)*
Morning Peak Hour Traffic	95th percentile queue (ft.)			
1. Business US 1 & MD 24				
Eastbound Business US 1 left turn:	72	77	77	*300*
Eastbound Business US 1 thru:	320	341	341	*n/a*
Westbound Business US 1 left turn:	164	177	183	*300*
Westbound Business US 1 thru:	445	475	475	*n/a*
Northbound MD 24 left turn:	172	197	197	*850*
Northbound MD 24 thru:	244	290	295	*850*
Northbound MD 24 right turn:	274	295	303	*1300*
Southbound MD 24 left turn:	76	81	81	*550*
Southbound MD 24 thru:	382	429	435	*850*
Southbound MD 24 right turn:	105	112	112	*900*
2. MD 924 & MacPhail Rd				
Eastbound MacPhail Rd approach:	192	205	205	*n/a*
with improvements:				
Eastbound MacPhail Rd left/thru:			*107*	*n/a*
Eastbound MacPhail Rd right turn:			*98*	*n/a*
Westbound MacPhail Rd left turn:	153	167	178	*180*
Westbound MacPhail Rd thru/right:	143	121	155	*n/a*
Northbound MD 924 left turn:	104	111	111	*250*
Northbound MD 924 thru/right:	578	622	637	*n/a*
Southbound MD 924 left turn:	30	32	32	*200*
Southbound MD 924 thru:	381	417	424	*n/a*
Southbound MD 924 right turn:	60	65	65	*400*
3. MD 24 & Ring Factory Rd				
Eastbound Ring Factory Rd left/thru:	104	130	130	*n/a*
Eastbound Ring Factory Rd right turn:	84	228	235	*100*
Westbound Ring Factory Rd left/thru:	361	428	431	*n/a*
Westbound Ring Factory Rd right turn:	176	208	208	*200*
Northbound MD 24 left turn:	26	67	75	*420*
Northbound MD 24 thru:	690	759	768	*n/a*
Northbound MD 24 right turn:	142	167	169	*410*
Southbound MD 24 left turn:	51	62	62	*550*
Southbound MD 24 thru:	699	771	783	*n/a*
Southbound MD 24 right turn:	14	20	20	*580*
4. MD 924 & Ring Factory Rd				
Eastbound Ring Factory Rd left turn:	151	161	161	*200*
Eastbound Ring Factory Rd thru/right:	78	100	100	*n/a*
Westbound Ring Factory Rd left/thru:	152	216	234	*n/a*
with Improvements				
Westbound Ring Factory Rd left turn:			*108*	*n/a*
Westbound Ring Factory Rd thru:			*126*	*n/a*
Westbound Ring Factory Rd right turn:	<25	<25	<25	*130*
Northbound MD 924 left turn:	106	113	113	*400*
Northbound MD 924 thru:	528	568	583	*n/a*
Northbound MD 924 right turn:	36	43	56	*225*
Southbound MD 924 left turn:	<25	<25	<25	*400*
Southbound MD 924 thru:	473	517	536	*n/a*
Southbound MD 924 right turn:	148	158	158	*215*

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EXHIBIT 15A
RESULTS OF INTERSECTION
QUEUING ANALYSES

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SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	*Available Storage Length (ft.)*
Morning Peak Hour Traffic	95th percentile queue (ft.)			
5. MD 924 & Patterson Mill Rd / Barrington Pl				
Eastbound Barrington Pl left/thru:	<25	<25	<25	*n/a*
Eastbound Barrington Pl right turn:	<25	25	27	*n/a*
Westbound Patterson Mill Rd left turn:	257	278	296	*110*
Westbound Patterson Mill Rd thru/right:	130	138	138	*n/a*
Northbound MD 924 left turn:	<25	<25	<25	*170*
Northbound MD 924 thru:	436	474	502	*n/a*
Northbound MD 924 right turn:	352	378	394	*240*
Southbound MD 924 left turn:	127	136	136	*500*
Southbound MD 924 thru:	534	589	625	*n/a*
Southbound MD 924 right turn:	<25	<25	<25	*230*
6. Plumtree Rd & Tollgate Rd				
Southbound Tollgate Rd approach:	<25	<25	<25	*n/a*
Eastbound Plumtree Rd approach:	<25	<25	<25	*n/a*
7. MD 24 & Plumtree Rd				
Eastbound Plumtree Rd left/thru:	72	77	97	*125*
Eastbound Plumtree Rd right turn:	138	153	158	*125*
Westbound Plumtree Rd left turn:	134	147	162	*200*
with 2nd left turn lane:			97	*200*
Westbound Plumtree Rd thru:	61	65	82	*n/a*
Westbound Plumtree Rd right turn:	146	155	191	*200*
Northbound MD 24 left turn:	65	76	81	*550*
Northbound MD 24 thru:	731	833	828	*n/a*
Northbound MD 24 right turn:	160	191	217	*520*
Southbound MD 24 left turn:	90	102	140	*525*
with 2nd left turn lane:			*84*	*525*
Southbound MD 24 thru:	699	868	863	*n/a*
Southbound MD 24 right turn:	<25	<25	<25	*550*
8. MD 924 & Plumtree Rd				
Eastbound Plumtree Rd left turn:	85	110	133	*150*
Eastbound Plumtree Rd thru/right:	66	70	70	*n/a*
Westbound Plumtree Rd left turn:	<25	25	25	*120*
Westbound Plumtree Rd thru:	<25	<25	<25	*n/a*
Westbound Plumtree Rd right turn:	<25	<25	<25	*120*
Northbound MD 924 left turn:	154	165	165	*300*
Northbound MD 924 thru:	697	756	779	*n/a*
Northbound MD 924 right turn:	<25	<25	<25	*500*
Southbound MD 924 left turn:	<25	<25	<25	*500*
Southbound MD 924 thru:	648	713	741	*n/a*
Southbound MD 924 right turn:	121	131	159	*n/a*
9. Bel Air South Pkwy & Tollgate Rd				
Eastbound approach:	<25	<25	<25	*n/a*
Westbound Bel Air South Pkwy left/thru:	<25	<25	<25	*470*
Westbound Bel Air South Pkwy right turn:	<25	<25	<25	*470*

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EXHIBIT 15A
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	*Available Storage Length (ft.)*
Morning Peak Hour Traffic	95th percentile queue (ft.)			
10. MD 24 & Bel Air South Pkwy				
Eastbound Bel Air South Pkwy left/thru:	183	208	219	*470*
with improvements				
Eastbound Bel Air South Pkwy left:			*133*	*470*
Eastbound Bel Air South Pkwy thru:			*144*	*470*
Eastbound Bel Air South Pkwy right turn:	76	156	156	*470*
Westbound Bel Air South Pkwy left/thru:	199	213	273	*n/a*
with improvements				
Westbound Bel Air South Pkwy left:			*192*	*n/a*
Westbound Bel Air South Pkwy thru:			*135*	*n/a*
Westbound Bel Air South Pkwy right turn:	135	148	167	*550*
Northbound MD 24 left turn:	69	92	92	*650*
Northbound MD 24 thru:	683	784	787	*n/a*
Northbound MD 24 right turn:	126	134	219	*650*
Southbound MD 24 left turn:	75	82	92	*810*
Southbound MD 24 thru:	698	868	865	*n/a*
Southbound MD 24 right turn:	169	186	186	*860*
11. Bel Air South Pkwy & Blue Spruce Dr				
Eastbound Bel Air South Pkwy left turn:	50	57	151	*150*
Northbound Blue Spruce Dr left/thru:	43	46	48	*n/a*
Northbound Blue Spruce Dr right turn:	30	32	32	*n/a*
Southbound Blue Spruce Dr approach:	<25	29	151	*n/a*
with improvements				
Southbound Blue Spruce Dr left/thru:			*37*	*n/a*
Southbound Blue Spruce Dr right turn:			*114*	*n/a*
12. MD 924 & Bel Air South Pkwy				
Eastbound Bel Air South Pkwy left turn:	122	131	131	*230*
Eastbound Bel Air South Pkwy thru:	59	64	78	*n/a*
Eastbound Bel Air South Pkwy right turn:	27	30	40	*n/a*
with improvements				
Eastbound Bel Air South Pkwy left turn:			*79*	*n/a*
Eastbound Bel Air South Pkwy thru/right:			*118*	*n/a*
Westbound Laurel Bush Rd left turn:	<25	<25	<25	*160*
Westbound Laurel Bush Rd thru:	143	153	168	*n/a*
Westbound Laurel Bush Rd right turn:	351	375	396	*210*
Northbound MD 924 left turn:	37	40	53	*500*
Northbound MD 924 thru/right:	339	375	392	*n/a*
with 2nd thru lane			*216*	*n/a*
Southbound MD 924 left turn:	152	163	181	*350*
Southbound MD 924 thru:	344	391	405	*n/a*
Southbound MD 924 right turn:	193	208	208	*500*

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EXHIBIT 15A
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	*Available Storage Length (ft.)*
Morning Peak Hour Traffic	95th percentile queue (ft.)			
14. MD 24 & Wheel Rd				
Eastbound Wheel Rd left/thru:	133	142	158	*n/a*
with improvements				
Eastbound Wheel Rd left:			*69*	*n/a*
Eastbound Wheel Rd thru:			*89*	*n/a*
Eastbound Wheel Rd right turn:	107	123	123	*150*
Westbound Wheel Rd left turn:	152	162	162	*410*
Westbound Wheel Rd thru/right:	113	120	120	*n/a*
with improvements				
Westbound Wheel Rd thru:			*79*	*n/a*
Westbound Wheel Rd right:			*41*	*n/a*
Northbound MD 24 left turn:	28	35	35	*285*
Northbound MD 24 thru:	728	843	884	*n/a*
Northbound MD 24 right turn:	114	123	123	*625*
Southbound MD 24 left turn:	62	67	67	*250*
Southbound MD 24 thru:	800	1019	1054	*n/a*
Southbound MD 24 right turn:	55	58	71	*670*
15. MD 924 & Wheel Rd				
Eastbound Wheel Rd left turn:	<25	<25	<25	*350*
Eastbound Wheel Rd thru/right:	173	185	185	*n/a*
Westbound Wheel Rd left turn:	82	90	90	*210*
Westbound Wheel Rd thru/right:	153	164	165	*n/a*
Northbound MD 924 left turn:	58	61	61	*120*
Northbound MD 924 thru:	378	417	446	*n/a*
Northbound MD 924 right turn:	72	79	79	*330*
Southbound MD 924 left turn:	<25	<25	<25	*350*
Southbound MD 924 thru/right:	334	382	401	*n/a*
17. MD 24 & Singer Rd				
Eastbound Singer Rd left turn:	140	159	174	*230*
Eastbound Singer Rd thru:	182	215	215	*n/a*
Eastbound Singer Rd right turn:	265	322	322	*250*
Westbound Singer Rd left turn:	239	256	256	*320*
with 2nd left turn lane:			*153*	*320*
Westbound Singer Rd thru:	254	277	277	*n/a*
Westbound Singer Rd right turn:	120	139	145	*320*
Northbound MD 24 left turn:	72	86	86	*310*
Northbound MD 24 thru:	554	648	677	*n/a*
Northbound MD 24 right turn:	32	34	34	*680*
Southbound MD 24 left turn:	104	135	140	*280*
with 2nd left turn lane:			*84*	*280*
Southbound MD 24 thru:	976	1194	1219	*n/a*
Southbound MD 24 right turn:	99	113	127	*650*

EXHIBIT 15A
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	*Available Storage Length (ft.)*
Morning Peak Hour Traffic	95th percentile queue (ft.)			
18. MD 924 & Singer Rd				
Eastbound Singer Rd left turn:	49	53	61	*270*
Eastbound Singer Rd thru/right:	215	266	266	*n/a*
with improvements				
Eastbound Singer Rd thru:			*151*	*n/a*
Eastbound Singer Rd right turn:			*115*	*n/a*
Westbound Singer Rd left turn:	74	85	85	*150*
Westbound Singer Rd thru:	179	195	195	*n/a*
Westbound Singer Rd right turn:	94	101	112	*150*
Northbound MD 924 left turn:	55	68	68	*300*
Northbound MD 924 thru:	249	280	287	*n/a*
Northbound MD 924 right turn:	60	67	67	*150*
Southbound MD 924 left turn:	109	116	126	*300*
Southbound MD 924 thru:	361	412	418	*n/a*
Southbound MD 924 right turn:	61	66	71	*150*
19. Plumtree Rd & Site Access				
Westbound Plumtree Rd left turn:			32	*n/a*
Westbound Plumtree Rd thru:			272	*n/a*
Eastbound Plumtree Rd thru:			260	*n/a*
Eastbound Plumtree Rd right turn:			67	*n/a*
Northbound Site Access left turn:			54	*n/a*
Northbound Site Access right turn:			25	*n/a*
20. MD 924 & Bright Oaks Dr / Site Access				
Westbound Bright Oaks Dr left/thru:	40	47	68	*n/a*
Westbound Bright Oaks Dr right turn:	127	136	136	*190*
Eastbound Site Access left/thru:			46	*n/a*
Eastbound Site Access right turn:			38	*n/a*
Northbound MD 924 left turn:			46	*n/a*
Northbound MD 924 thru:			808	*n/a*
Northbound MD 924 right turn:			32	*160*
Southbound MD 924 left turn:	28	30	30	*n/a*
Southbound MD 924 thru:			731	*n/a*
Southbound MD 924 right turn:			34	*n/a*

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EXHIBIT 15A
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	Available Storage Length (ft.)
Evening Peak Hour Traffic	95th percentile queue (ft.)			
1. Business US 1 & MD 24				
Eastbound Business US 1 left turn:	238	253	253	*300*
Eastbound Business US 1 thru:	659	704	704	*n/a*
Westbound Business US 1 left turn:	280	308	321	*300*
Westbound Business US 1 thru:	597	637	637	*n/a*
Northbound MD 24 left turn:	313	350	350	*850*
Northbound MD 24 thru:	642	723	735	*850*
Northbound MD 24 right turn:	402	444	465	*1300*
Southbound MD 24 left turn:	210	224	224	*550*
Southbound MD 24 thru:	401	468	479	*850*
Southbound MD 24 right turn:	171	182	182	*900*
2. MD 924 & MacPhail Rd				
Eastbound MacPhail Rd approach:	91	97	205	*n/a*
with improvements:				
Eastbound MacPhail Rd left/thru:			*107*	*n/a*
Eastbound MacPhail Rd right turn:			*98*	*n/a*
Westbound MacPhail Rd left turn:	156	176	178	*180*
Westbound MacPhail Rd thru/right:	111	121	155	*n/a*
Northbound MD 924 left turn:	25	27	111	*250*
Northbound MD 924 thru/right:	859	945	637	*n/a*
Southbound MD 924 left turn:	47	53	32	*200*
Southbound MD 924 thru:	601	652	424	*n/a*
Southbound MD 924 right turn:	<25	<25	65	*400*
3. MD 24 & Ring Factory Rd				
Eastbound Ring Factory Rd left/thru:	158	180	180	*n/a*
Eastbound Ring Factory Rd right turn:	80	171	181	*100*
Westbound Ring Factory Rd left/thru:	179	219	222	*n/a*
Westbound Ring Factory Rd right turn:	192	217	217	*200*
Northbound MD 24 left turn:	88	252	259	*420*
Northbound MD 24 thru:	1148	1271	1294	*n/a*
Northbound MD 24 right turn:	343	413	417	*410*
Southbound MD 24 left turn:	137	168	168	*550*
Southbound MD 24 thru:	949	1052	1074	*n/a*
Southbound MD 24 right turn:	25	47	47	*580*
4. MD 924 & Ring Factory Rd				
Eastbound Ring Factory Rd left turn:	255	272	272	*200*
Eastbound Ring Factory Rd thru/right:	220	282	282	*n/a*
Westbound Ring Factory Rd left/thru:	110	163	191	*n/a*
with Improvements				
Westbound Ring Factory Rd left turn:			*118*	*n/a*
Westbound Ring Factory Rd thru:			*73*	*n/a*
Westbound Ring Factory Rd right turn:	<25	<25	<25	*130*
Northbound MD 924 left turn:	95	101	101	*400*
Northbound MD 924 thru:	650	722	752	*n/a*
Northbound MD 924 right turn:	74	100	129	*225*
Southbound MD 924 left turn:	<25	<25	<25	*400*
Southbound MD 924 thru:	603	663	694	*n/a*
Southbound MD 924 right turn:	132	141	141	*215*

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EXHIBIT 15A CONT'D
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	**Existing Traffic**	**Background Traffic**	**Total Traffic**	***Available Storage Length (ft.)***
Evening Peak Hour Traffic	95th percentile queue (ft.)			
5. MD 924 & Patterson Mill Rd / Barrington Pl				
Eastbound Barrington Pl left/thru:	<25	<25	<25	*n/a*
Eastbound Barrington Pl right turn:	<25	<25	<25	*n/a*
Westbound Patterson Mill Rd left turn:	72	88	113	*110*
Westbound Patterson Mill Rd thru/right:	63	67	67	*n/a*
Northbound MD 924 left turn:	<25	<25	25	*170*
Northbound MD 924 thru:	830	935	994	*n/a*
Northbound MD 924 right turn:	99	116	137	*240*
Southbound MD 924 left turn:	57	60	60	*500*
Southbound MD 924 thru:	687	774	832	*n/a*
Southbound MD 924 right turn:	<25	<25	<25	*230*
6. Plumtree Rd & Tollgate Rd				
Southbound Tollgate Rd approach:	29	32	35	*n/a*
Eastbound Plumtree Rd approach:	<25	<25	<25	*n/a*
7. MD 24 & Plumtree Rd				
Eastbound Plumtree Rd left/thru:	109	117	148	*125*
Eastbound Plumtree Rd right turn:	224	259	265	*125*
Westbound Plumtree Rd left turn:	210	248	303	*200*
with 2nd left turn lane:			*182*	*200*
Westbound Plumtree Rd thru:	117	125	158	*n/a*
Westbound Plumtree Rd right turn:	201	219	320	*200*
Northbound MD 24 left turn:	217	249	256	*550*
Northbound MD 24 thru:	1395	1645	1616	*n/a*
Northbound MD 24 right turn:	193	210	294	*520*
Southbound MD 24 left turn:	165	177	284	*525*
with 2nd left turn lane:			*170*	*525*
Southbound MD 24 thru:	966	1132	1103	*n/a*
Southbound MD 24 right turn:	45	47	47	*550*
8. MD 924 & Plumtree Rd				
Eastbound Plumtree Rd left turn:	132	144	182	*150*
Eastbound Plumtree Rd thru/right:	172	184	184	*n/a*
Westbound Plumtree Rd left turn:	86	92	92	*120*
Westbound Plumtree Rd thru:	55	59	59	*n/a*
Westbound Plumtree Rd right turn:	40	43	43	*120*
Northbound MD 924 left turn:	192	205	205	*300*
Northbound MD 924 thru:	782	894	936	*n/a*
Northbound MD 924 right turn:	47	51	51	*500*
Southbound MD 924 left turn:	33	36	36	*500*
Southbound MD 924 thru:	670	768	812	*n/a*
Southbound MD 924 right turn:	79	103	145	*n/a*
9. Bel Air South Pkwy & Tollgate Rd				
Eastbound approach:	<25	<25	<25	*n/a*
Westbound Bel Air South Pkwy left/thru:	26	28	30	*470*
Westbound Bel Air South Pkwy right turn:	<25	<25	<25	*470*

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EXHIBIT 15A CONT'D
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	**Existing Traffic**	**Background Traffic**	**Total Traffic**	***Available Storage Length (ft.)***
Evening Peak Hour Traffic	**95th percentile queue (ft.)**			
10. MD 24 & Bel Air South Pkwy				
Eastbound Bel Air South Pkwy left/thru:	260	287	307	*470*
with improvements				
Eastbound Bel Air South Pkwy left:			*166*	*470*
Eastbound Bel Air South Pkwy thru:			*235*	*470*
Eastbound Bel Air South Pkwy right turn:	58	108	108	*470*
Westbound Bel Air South Pkwy left/thru:	227	243	370	*n/a*
with improvements				
Westbound Bel Air South Pkwy left:			*251*	*n/a*
Westbound Bel Air South Pkwy thru:			*198*	*n/a*
Westbound Bel Air South Pkwy right turn:	420	454	513	*550*
Northbound MD 24 left turn:	68	160	160	*650*
Northbound MD 24 thru:	1230	1472	1456	*n/a*
Northbound MD 24 right turn:	356	379	554	*650*
Southbound MD 24 left turn:	206	222	261	*810*
Southbound MD 24 thru:	897	1067	1039	*n/a*
Southbound MD 24 right turn:	224	263	263	*860*
11. Bel Air South Pkwy & Blue Spruce Dr				
Eastbound Bel Air South Pkwy left turn:	74	84	277	*150*
Northbound Blue Spruce Dr left/thru:	135	144	146	*n/a*
Northbound Blue Spruce Dr right turn:	158	168	168	*n/a*
Southbound Blue Spruce Dr approach:	46	61	306	*n/a*
with improvements				
Southbound Blue Spruce Dr left/thru:			*78*	*n/a*
Southbound Blue Spruce Dr right turn:			*228*	*n/a*
12. MD 924 & Bel Air South Pkwy				
Eastbound Bel Air South Pkwy left turn:	287	311	311	*230*
Eastbound Bel Air South Pkwy thru:	237	255	274	*n/a*
Eastbound Bel Air South Pkwy right turn:	84	90	112	*n/a*
with improvements				
Eastbound Bel Air South Pkwy left turn:			*186*	*n/a*
Eastbound Bel Air South Pkwy thru/right:			*386*	*n/a*
Westbound Laurel Bush Rd left turn:	45	47	47	*160*
Westbound Laurel Bush Rd thru:	196	211	231	*n/a*
Westbound Laurel Bush Rd right turn:	297	317	346	*210*
Northbound MD 924 left turn:	83	89	111	*500*
Northbound MD 924 thru/right:	508	608	634	*n/a*
with 2nd thru lane			*349*	*n/a*
Southbound MD 924 left turn:	208	222	248	*350*
Southbound MD 924 thru:	417	504	530	*n/a*
Southbound MD 924 right turn:	205	224	224	*500*

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EXHIBIT 15A CONT'D
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	*Available Storage Length (ft.)*
Evening Peak Hour Traffic	95th percentile queue (ft.)			
14. MD 24 & Wheel Rd				
Eastbound Wheel Rd left/thru:	197	210	238	*n/a*
with improvements				
Eastbound Wheel Rd left:			*91*	*n/a*
Eastbound Wheel Rd thru:			*147*	*n/a*
Eastbound Wheel Rd right turn:	32	63	63	*150*
Westbound Wheel Rd left turn:	305	326	326	*410*
Westbound Wheel Rd thru/right:	315	336	336	*n/a*
with improvements				
Westbound Wheel Rd thru:			*182*	*n/a*
Westbound Wheel Rd right:			*154*	*n/a*
Northbound MD 24 left turn:	105	142	142	*285*
Northbound MD 24 thru:	1354	1652	1717	*n/a*
Northbound MD 24 right turn:	445	475	475	*625*
Southbound MD 24 left turn:	152	163	163	*250*
Southbound MD 24 thru:	927	1125	1183	*n/a*
Southbound MD 24 right turn:	93	100	126	*670*
15. MD 924 & Wheel Rd				
Eastbound Wheel Rd left turn:	46	50	50	*350*
Eastbound Wheel Rd thru/right:	353	376	376	*n/a*
Westbound Wheel Rd left turn:	88	103	103	*210*
Westbound Wheel Rd thru/right:	236	252	254	*n/a*
Northbound MD 924 left turn:	130	138	138	*120*
Northbound MD 924 thru:	500	601	648	*n/a*
Northbound MD 924 right turn:	151	172	172	*330*
Southbound MD 924 left turn:	48	52	53	*350*
Southbound MD 924 thru/right:	482	575	401	*n/a*
17. MD 24 & Singer Rd				
Eastbound Singer Rd left turn:	151	169	197	*230*
Eastbound Singer Rd thru:	344	381	381	*n/a*
Eastbound Singer Rd right turn:	72	104	104	*250*
Westbound Singer Rd left turn:	76	81	81	*320*
with 2nd left turn lane:			*49*	*320*
Westbound Singer Rd thru:	366	420	420	*n/a*
Westbound Singer Rd right turn:	185	252	259	*320*
Northbound MD 24 left turn:	260	324	324	*310*
Northbound MD 24 thru:	1435	1721	1768	*n/a*
Northbound MD 24 right turn:	222	236	236	*680*
Southbound MD 24 left turn:	231	291	295	*280*
with 2nd left turn lane:			*177*	*280*
Southbound MD 24 thru:	853	1031	1074	*n/a*
Southbound MD 24 right turn:	224	251	274	*650*

SHA Methodology

Evening Peak Hour Traffic	Existing Traffic	Background Traffic	Total Traffic	Available Storage Length (ft.)
	95th percentile queue (ft.)			
18. MD 924 & Singer Rd				
Eastbound Singer Rd left turn:	50	53	66	*270*
Eastbound Singer Rd thru/right:	143	200	200	*n/a*
with improvements				
Eastbound Singer Rd thru:			*118*	*n/a*
Eastbound Singer Rd right turn:			*82*	*n/a*
Westbound Singer Rd left turn:	32	37	37	*150*
Westbound Singer Rd thru:	81	99	99	*n/a*
Westbound Singer Rd right turn:	74	79	97	*150*
Northbound MD 924 left turn:	70	127	127	*300*
Northbound MD 924 thru:	360	461	475	*n/a*
Northbound MD 924 right turn:	67	76	76	*150*
Southbound MD 924 left turn:	107	115	131	*300*
Southbound MD 924 thru:	178	257	271	*n/a*
Southbound MD 924 right turn:	47	51	66	*150*
19. Plumtree Rd & Site Access				
Westbound Plumtree Rd left turn:			55	*n/a*
Westbound Plumtree Rd thru:			383	*n/a*
Eastbound Plumtree Rd thru:			311	*n/a*
Eastbound Plumtree Rd right turn:			159	*n/a*
Northbound Site Access left turn:			137	*n/a*
Northbound Site Access right turn:			50	*n/a*
20. MD 924 & Bright Oaks Dr / Site Access				
Westbound Bright Oaks Dr left/thru:	<25	36	65	*n/a*
Westbound Bright Oaks Dr right turn:	84	89	89	*190*
Eastbound Site Access left/thru:			88	*n/a*
Eastbound Site Access right turn:			74	*n/a*
Northbound MD 924 left turn:			79	*n/a*
Northbound MD 924 thru:			1047	*n/a*
Northbound MD 924 right turn:			90	*160*
Southbound MD 924 left turn:	94	100	100	*n/a*
Southbound MD 924 thru:			840	*n/a*
Southbound MD 924 right turn:			69	*n/a*

SHA Methodology

Saturday Midday Peak Hour Traffic	Existing Traffic	Background Traffic	Total Traffic	Available Storage Length (ft.)
	95th percentile queue (ft.)			
1. Business US 1 & MD 24				
Eastbound Business US 1 left turn:	206	221	221	*300*
Eastbound Business US 1 thru:	496	529	529	*n/a*
Westbound Business US 1 left turn:	351	389	405	*300*
Westbound Business US 1 thru:	555	593	593	*n/a*
Northbound MD 24 left turn:	343	380	380	*850*
Northbound MD 24 thru:	467	535	549	*850*
Northbound MD 24 right turn:	455	508	534	*1300*
Southbound MD 24 left turn:	243	260	260	*550*
Southbound MD 24 thru:	484	556	570	*850*
Southbound MD 24 right turn:	176	188	188	*900*
2. MD 924 & MacPhail Rd				
Eastbound MacPhail Rd approach:	94	100	100	*n/a*
with improvements:				
Eastbound MacPhail Rd left/thru:			*49*	*n/a*
Eastbound MacPhail Rd right turn:			*51*	*n/a*
Westbound MacPhail Rd left turn:	151	177	199	*180*
Westbound MacPhail Rd thru/right:	74	81	81	*n/a*
Northbound MD 924 left turn:	16	17	17	*250*
Northbound MD 924 thru/right:	683	760	797	*n/a*
Southbound MD 924 left turn:	53	60	60	*200*
Southbound MD 924 thru:	650	711	731	*n/a*
Southbound MD 924 right turn:	<25	<25	<25	*400*
3. MD 24 & Ring Factory Rd				
Eastbound Ring Factory Rd left/thru:	152	176	176	*n/a*
Eastbound Ring Factory Rd right turn:	117	231	240	*100*
Westbound Ring Factory Rd left/thru:	211	277	280	*n/a*
Westbound Ring Factory Rd right turn:	272	314	314	*200*
Northbound MD 24 left turn:	71	196	203	*420*
Northbound MD 24 thru:	984	1091	1120	*n/a*
Northbound MD 24 right turn:	102	167	169	*410*
Southbound MD 24 left turn:	205	247	247	*550*
Southbound MD 24 thru:	997	1107	1137	*n/a*
Southbound MD 24 right turn:	39	58	58	*580*
4. MD 924 & Ring Factory Rd				
Eastbound Ring Factory Rd left turn:	103	110	110	*200*
Eastbound Ring Factory Rd thru/right:	163	232	232	*n/a*
Westbound Ring Factory Rd left/thru:	138	232	270	*n/a*
with Improvements				
Westbound Ring Factory Rd left turn:			*153*	*n/a*
Westbound Ring Factory Rd thru:			*116*	*n/a*
Westbound Ring Factory Rd right turn:	26	28	153	*130*
Northbound MD 924 left turn:	158	169	169	*400*
Northbound MD 924 thru:	544	613	649	*n/a*
Northbound MD 924 right turn:	64	99	135	*225*
Southbound MD 924 left turn:	<25	<25	<25	*400*
Southbound MD 924 thru:	662	739	781	*n/a*
Southbound MD 924 right turn:	145	155	155	*215*

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EXHIBIT 15A CONT'D
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	*Available Storage Length (ft.)*
Saturday Midday Peak Hour Traffic	95th percentile queue (ft.)			
5. MD 924 & Patterson Mill Rd / Barrington Pl				
Eastbound Barrington Pl left/thru:	<25	<25	<25	*n/a*
Eastbound Barrington Pl right turn:	<25	<25	<25	*n/a*
Westbound Patterson Mill Rd left turn:	193	223	253	*110*
Westbound Patterson Mill Rd thru/right:	162	172	172	*n/a*
Northbound MD 924 left turn:	<25	<25	<25	*170*
Northbound MD 924 thru:	584	685	758	*n/a*
Northbound MD 924 right turn:	299	335	362	*240*
Southbound MD 924 left turn:	158	168	168	*500*
Southbound MD 924 thru:	663	777	856	*n/a*
Southbound MD 924 right turn:	<25	<25	<25	*230*
6. Plumtree Rd & Tollgate Rd				
Southbound Tollgate Rd approach:	33	37	41	*n/a*
Eastbound Plumtree Rd approach:	<25	<25	<25	*n/a*
7. MD 24 & Plumtree Rd				
Eastbound Plumtree Rd left/thru:	133	142	184	*125*
Eastbound Plumtree Rd right turn:	245	294	299	*125*
Westbound Plumtree Rd left turn:	197	213	266	*200*
with 2nd left turn lane:			*160*	*200*
Westbound Plumtree Rd thru:	106	113	150	*n/a*
Westbound Plumtree Rd right turn:	160	171	282	*200*
Northbound MD 24 left turn:	163	200	205	*550*
Northbound MD 24 thru:	998	1203	1174	*n/a*
Northbound MD 24 right turn:	108	119	209	*520*
Southbound MD 24 left turn:	134	144	263	*525*
with 2nd left turn lane:			*158*	*525*
Southbound MD 24 thru:	1023	1221	1193	*n/a*
Southbound MD 24 right turn:	<25	25	25	*550*
8. MD 924 & Plumtree Rd				
Eastbound Plumtree Rd left turn:	109	118	169	*150*
Eastbound Plumtree Rd thru/right:	174	186	186	*n/a*
Westbound Plumtree Rd left turn:	109	116	116	*120*
Westbound Plumtree Rd thru:	60	64	64	*n/a*
Westbound Plumtree Rd right turn:	60	64	64	*120*
Northbound MD 924 left turn:	161	172	172	*300*
Northbound MD 924 thru:	604	724	774	*n/a*
Northbound MD 924 right turn:	58	61	61	*500*
Southbound MD 924 left turn:	57	60	60	*500*
Southbound MD 924 thru:	724	862	916	*n/a*
Southbound MD 924 right turn:	124	135	192	*n/a*
9. Bel Air South Pkwy & Tollgate Rd				
Eastbound approach:	<25	<25	<25	*n/a*
Westbound Bel Air South Pkwy left/thru:	<25	<25	27	*470*
Westbound Bel Air South Pkwy right turn:	<25	<25	<25	*470*

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EXHIBIT 15A CONT'D
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	**Existing Traffic**	**Background Traffic**	**Total Traffic**	***Available Storage Length (ft.)***
Saturday Midday Peak Hour Traffic	**95th percentile queue (ft.)**			
10. MD 24 & Bel Air South Pkwy				
Eastbound Bel Air South Pkwy left/thru:	207	231	254	*470*
with improvements				
Eastbound Bel Air South Pkwy left:			*137*	*470*
Eastbound Bel Air South Pkwy thru:			*194*	*470*
Eastbound Bel Air South Pkwy right turn:	39	95	95	*470*
Westbound Bel Air South Pkwy left/thru:	276	297	450	*n/a*
with improvements				
Westbound Bel Air South Pkwy left:			*332*	*n/a*
Westbound Bel Air South Pkwy thru:			*198*	*n/a*
Westbound Bel Air South Pkwy right turn:	441	475	532	*550*
Northbound MD 24 left turn:	37	92	92	*650*
Northbound MD 24 thru:	786	984	972	*n/a*
Northbound MD 24 right turn:	256	273	483	*650*
Southbound MD 24 left turn:	292	317	355	*810*
Southbound MD 24 thru:	889	1086	1058	*n/a*
Southbound MD 24 right turn:	231	260	260	*860*
11. Bel Air South Pkwy & Blue Spruce Dr				
Eastbound Bel Air South Pkwy left turn:	122	138	357	*150*
Northbound Blue Spruce Dr left/thru:	151	163	165	*n/a*
Northbound Blue Spruce Dr right turn:	198	211	211	*n/a*
Southbound Blue Spruce Dr approach:	43	59	346	*n/a*
with improvements				
Southbound Blue Spruce Dr left/thru:			*101*	*n/a*
Southbound Blue Spruce Dr right turn:			*245*	*n/a*
12. MD 924 & Bel Air South Pkwy				
Eastbound Bel Air South Pkwy left turn:	276	298	298	*230*
Eastbound Bel Air South Pkwy thru:	179	193	219	*n/a*
Eastbound Bel Air South Pkwy right turn:	82	89	117	*n/a*
with improvements				
Eastbound Bel Air South Pkwy left turn:			*179*	*n/a*
Eastbound Bel Air South Pkwy thru/right:			*336*	*n/a*
Westbound Laurel Bush Rd left turn:	38	40	40	*160*
Westbound Laurel Bush Rd thru:	186	201	229	*n/a*
Westbound Laurel Bush Rd right turn:	201	215	249	*210*
Northbound MD 924 left turn:	64	71	101	*500*
Northbound MD 924 thru/right:	454	576	609	*n/a*
with 2nd thru lane			*335*	*n/a*
Southbound MD 924 left turn:	187	200	229	*350*
Southbound MD 924 thru:	431	558	590	*n/a*
Southbound MD 924 right turn:	294	324	324	*500*

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EXHIBIT 15A CONT'D
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology	Existing Traffic	Background Traffic	Total Traffic	*Available Storage Length (ft.)*
Saturday Midday Peak Hour Traffic	95th percentile queue (ft.)			
14. MD 24 & Wheel Rd				
Eastbound Wheel Rd left/thru:	148	159	193	*n/a*
with improvements				
Eastbound Wheel Rd left:			*98*	*n/a*
Eastbound Wheel Rd thru:			*95*	*n/a*
Eastbound Wheel Rd right turn:	54	106	106	*150*
Westbound Wheel Rd left turn:	319	340	340	*410*
Westbound Wheel Rd thru/right:	327	349	349	*n/a*
with improvements				
Westbound Wheel Rd thru:			*180*	*n/a*
Westbound Wheel Rd right:			*169*	*n/a*
Northbound MD 24 left turn:	51	100	100	*285*
Northbound MD 24 thru:	803	1031	1116	*n/a*
Northbound MD 24 right turn:	277	295	295	*625*
Southbound MD 24 left turn:	127	137	137	*250*
Southbound MD 24 thru:	951	1181	1258	*n/a*
Southbound MD 24 right turn:	102	109	142	*670*
15. MD 924 & Wheel Rd				
Eastbound Wheel Rd left turn:	32	34	34	*350*
Eastbound Wheel Rd thru/right:	262	279	279	*n/a*
Westbound Wheel Rd left turn:	89	111	111	*210*
Westbound Wheel Rd thru/right:	189	203	205	*n/a*
Northbound MD 924 left turn:	136	144	144	*120*
Northbound MD 924 thru:	466	590	651	*n/a*
Northbound MD 924 right turn:	93	114	114	*330*
Southbound MD 924 left turn:	36	39	41	*350*
Southbound MD 924 thru/right:	544	681	734	*n/a*
17. MD 24 & Singer Rd				
Eastbound Singer Rd left turn:	156	175	209	*230*
Eastbound Singer Rd thru:	247	281	281	*n/a*
Eastbound Singer Rd right turn:	104	158	158	*250*
Westbound Singer Rd left turn:	112	119	119	*320*
with 2nd left turn lane:			*72*	*320*
Westbound Singer Rd thru:	303	340	340	*n/a*
Westbound Singer Rd right turn:	186	268	276	*320*
Northbound MD 24 left turn:	167	231	231	*310*
Northbound MD 24 thru:	943	1164	1225	*n/a*
Northbound MD 24 right turn:	142	151	151	*680*
Southbound MD 24 left turn:	230	318	324	*280*
with 2nd left turn lane:			*195*	*280*
Southbound MD 24 thru:	936	1146	1203	*n/a*
Southbound MD 24 right turn:	168	189	221	*650*

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EXHIBIT 15A CONT'D
RESULTS OF INTERSECTION
QUEUING ANALYSES

SHA Methodology

Saturday Midday Peak Hour Traffic	Existing Traffic	Background Traffic	Total Traffic	Available Storage Length (ft.)
	95th percentile queue (ft.)			
18. MD 924 & Singer Rd				
Eastbound Singer Rd left turn:	73	78	97	*270*
Eastbound Singer Rd thru/right:	267	361	361	*n/a*
with improvements				
Eastbound Singer Rd thru:			*182*	*n/a*
Eastbound Singer Rd right turn:			*179*	*n/a*
Westbound Singer Rd left turn:	109	117	117	*150*
Westbound Singer Rd thru:	141	161	161	*n/a*
Westbound Singer Rd right turn:	148	158	181	*150*
Northbound MD 924 left turn:	102	170	170	*300*
Northbound MD 924 thru:	487	626	643	*n/a*
Northbound MD 924 right turn:	64	70	70	*150*
Southbound MD 924 left turn:	148	158	180	*300*
Southbound MD 924 thru:	447	592	609	*n/a*
Southbound MD 924 right turn:	68	73	89	*150*
19. Plumtree Rd & Site Access				
Westbound Plumtree Rd left turn:			69	*n/a*
Westbound Plumtree Rd thru:			319	*n/a*
Eastbound Plumtree Rd thru:			237	*n/a*
Eastbound Plumtree Rd right turn:			178	*n/a*
Northbound Site Access left turn:			146	*n/a*
Northbound Site Access right turn:			62	*n/a*
20. MD 924 & Bright Oaks Dr / Site Access				
Westbound Bright Oaks Dr left/thru:	41	63	96	*n/a*
Westbound Bright Oaks Dr right turn:	59	63	63	*190*
Eastbound Site Access left/thru:			102	*n/a*
Eastbound Site Access right turn:			83	*n/a*
Northbound MD 924 left turn:			92	*n/a*
Northbound MD 924 thru:			931	*n/a*
Northbound MD 924 right turn:			95	*160*
Southbound MD 924 left turn:	77	82	82	*n/a*
Southbound MD 924 thru:			991	*n/a*
Southbound MD 924 right turn:			79	*n/a*

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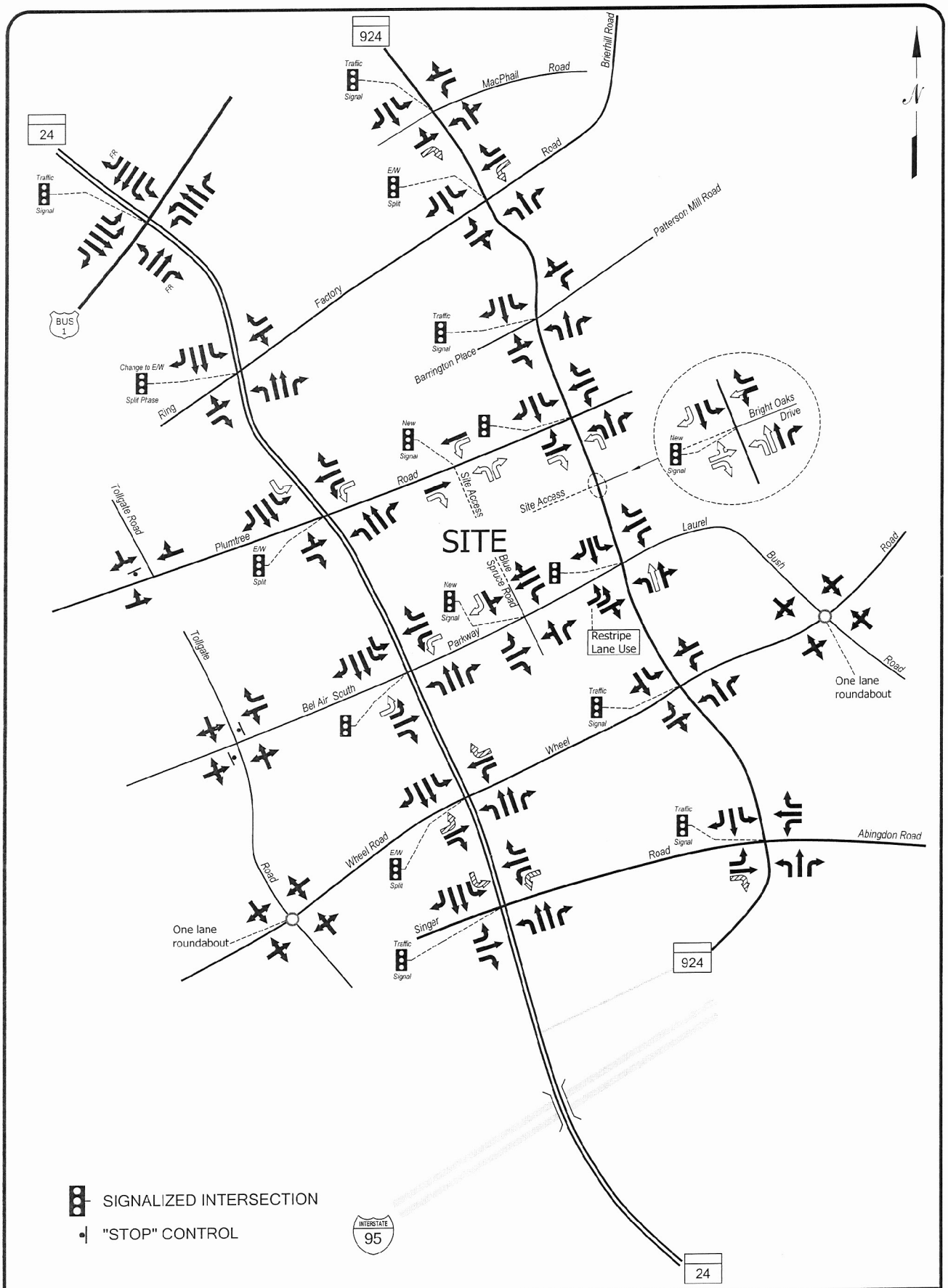
EXHIBIT 15A CONT'D
RESULTS OF INTERSECTION
QUEUING ANALYSES



NOT TO SCALE

EXISTING LANE USE
RECOMMENDED LANE USE
POTENTIAL LANE USE IF REQUIRED BY COUNTY

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EXHIBIT 16
RECOMMENDED FUTURE LANE USE

RESULTS, RECOMMENDATIONS, and CONCLUSIONS

STUDY PURPOSE

The Traffic Group, Inc. has prepared this Traffic Impact Analysis to determine the impact of the proposed development of a Walmart Retail Store on the surround area roadway system. Walmart is proposing an 189,564 sq. ft. Walmart Retail Store on approximately 17 acres of land within an approximately 34 acre site that is zoned for commercial uses. The subject site is located on the south side of Plumtree Road bounded by MD 24 to the west and MD 924 to the east

As typically requested by the Maryland State Highway Administration (SHA) and Harford County Government, general assumptions need to be made to the potential buildout of the remainder of the site for purposes of this Traffic Impact Analysis. To be conservative with this analysis, high trip generating uses were used for the approximate 17 acres of developable land.

Access to the property is proposed via one point along Plumtree Road, one point along MD 924, and a connection to Blue Spruce Drive. Blue Spruce Drive is proposed to be extended northerly to Plumtree Road from Bel Air South Parkway. At this time, no access is proposed to MD 24, since MD 24 is a controlled access highway. It is anticipated that access would not be granted by SHA if requested.

STUDY CRITERIA/METHODOLOGY

The Scope of Work for this Traffic Impact Study was prepared and approved by both Harford County and SHA in a meeting dated April 17, 2012. The Scope of Work can be found in Appendix A.

Harford County's Adequate Public Facilities Ordinance (APFO) requires the use of Highway Capacity Manual (HCM) Analysis for all study intersections. The Maryland State Highway Administration (SHA) requires the use of Critical Lane Volume (CLV) Analysis to quantify levels of service at state maintained intersections.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Based on the data and analyses found in this report, it is our opinion that the following road improvements would assist with operations throughout the region and would mitigate the Walmart Retail Store plus the additional proposed development on the subject site:

MD 24 at Plumtree Road

The HCM Analysis for this intersection projects Level of Service "E" conditions during the evening peak period under both background and total traffic conditions and acceptable Levels of Service throughout the other peak periods. CLV Analyses also indicates that during the evening peak hour under background and total conditions, Level of Service "F" conditions are projected and Level of Service "E" conditions are projected during the Saturday midday peak hour under total traffic conditions.

Suggested improvements at this intersection include adding a second southbound MD 24 left turn lane and a second westbound Plumtree Road left turn lane. These physical improvements along with changing the side street movements to a split phase mitigate the site's impact at this location.

MD 24 at Bel Air South Parkway

The HCM Analysis for this intersection projects Level of Service "E" conditions during the evening peak period under both background and total traffic conditions and acceptable Levels of Service throughout the other peak periods. SHA CLV Analyses also indicates that during the evening peak hour under background and total conditions, Level of Service "F" conditions are projected (under existing conditions, Level of Service "E" conditions are experienced) and Level of Service "E" conditions are projected during the Saturday midday peak hour under total traffic conditions.

To mitigate the site's impact, a second left turn lane is recommended along both eastbound and westbound Bel Air South Parkway onto MD 24.

Bel Air South Parkway at Blue Spruce Drive

Recently, Harford County had a Capital Improvement Program (CIP) project for the intersection of Bel Air South Parkway and Blue Spruce Road. The project was a fully funded single lane roundabout. Prior to the County Council finalizing the 2012 budget, funding was removed for this project. Because of the subject site's impact to this intersection, improvements are required. With the implementation of a traffic signal, minor street delay is reduced and an acceptable level of service can be provided. This improvement would mitigate the site's impacts.

MD 924 at Bel Air South Parkway

Currently, this intersection exhibits Level of Service "E" and "F" conditions during the evening and Saturday peak periods using both the HCM and SHA CLV Methodologies. In order to improve conditions, the following improvements are recommended:

- Provide an additional through lane in the northbound direction. It is anticipated that the northbound lane will continue north of the new site access and drop at Plumtree Road; and

- Provide a second eastbound left turn lane from Bel Air South Parkway onto northbound MD 924 while changing the right most lane to a shared through/right turn lane.

The implementation of these improvements mitigates the site's traffic impacts.

MD 924 at Bright Oaks Drive/Site Access

Traffic signalization is recommended to facilitate access to and egress from the site. In addition, a second through lane will be needed along northbound MD 924 within this road segment. A separate left turn lane is recommended along northbound 924. A separate right turn lane is needed along southbound MD 924. The site access approach should provide a shared left through lane and separate right turn lane.

Based on providing the improvements listed above, the Walmart Retail Store and the potential buildout of the remaining acreage of the site as depicted in this report should satisfy Harford County Guidelines.

Please be aware the road improvements that are detailed above have not been designed. Our recommendation for these road improvements are conceptual in nature and are based upon the mathematical computations/capacity analyses that are provided in this report. It is unlikely, at this point in the process, that The Traffic Group, Inc. has undertaken sufficient field work/design to determine the impact of the recommended road improvements on either above ground or below ground utilities, drainage conditions, or right-of-way conditions that would impact the feasibility or cost of making the improvements that we have recommended. The feasibility and cost of making these improvements will be undertaken in the next phase of our studies.